

Bioeconomy for Educators: Cultivating a Sustainable Future

GenB MOOC

Project Title	GenB
Contract No.	101060501
Instrument	Research and Innovation Action
Funded under	Cluster 6: Food, Bioeconomy Natural Resources, Agriculture and Environment
Start of Project	1 November 2022
Duration	30 months

OUR CONSORTIUM



Deliverable title	GenB MOOC: Bioeconomy for Educators: Cultivating a Sustainable Future
Deliverable number	
Deliverable version	Version number (e.g. "1.0")
Previous version(s)	Previous version numbers (if any)
Contractual date of delivery	Date of delivery according to DoA (e.g. 31 October 2021)
Actual date of delivery	Date of submission (e.g. 28 October 2021)
Deliverable filename	TEMPLATE WORD_GenB.docx
Nature of deliverable	Report/Demonstrator/etc.
Dissemination level	Public/Confidential
Number of pages	119
Work Package	WP number (e.g. WP1)
Task(s)	Corresponding tasks (e.g. T1.1)
Partner responsible	Beneficiary short name (e.g. CERTH)
Author(s)	John Smith (Organization X), Anna Smith (Organization Y), ...
Editor	e.g. John Smith (Organization X)
EC Project Officer	P.O. Name...
Abstract	Abstract (up to 8 lines)
Keywords	AI, Media, Fake News...

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1 Course Syllabus

GenB MOOC Bioeconomy for Educators: Cultivating a Sustainable Future



Figure 1. European Schoolnet Academy. (2024, August 20). Bioeconomy for Educators: Cultivating a Sustainable Future [Video]. YouTube. <https://www.youtube.com/watch?v=26NFwU896ec>

Join the "Bioeconomy for Educators: Cultivating a Sustainable Future" online course and learn how to explore sustainable economic solutions with your students! Bioeconomy uses renewable biological resources to produce goods, energy, and services, making it a critical area for students to understand in the 21st century. As a driver of economic growth and job creation, bioeconomy equips students with the skills to tackle future societal challenges. However, it's essential to address its associated challenges, such as resource competition and environmental impacts, to ensure a sustainable transition. How can you integrate these vital aspects into your classroom to prepare students for the bioeconomy?

Despite its potential, bioeconomy remains underrepresented in the public consciousness. Teachers have a key role in raising awareness of both the benefits and limitations of bioeconomy among future generations. This course introduces the concepts of bioeconomy and circular economy, showing their relevance to everyday life. You'll learn how to incorporate these topics into various subjects and educational settings, creating innovative and adaptable learning experiences. The course will also help you raise awareness of future job opportunities in bioeconomy and develop the essential 21st-century skills needed in this field. You will conclude by constructing a Learning Scenario to effectively implement bioeconomy topics in your teaching.

The course includes materials developed through GenB and other bioeconomy projects, offering lesson plans, educational games, job profiles, and more from the GenB Toolkit. You will also be introduced to the 7-Steps of Eco-Schools Methodology, a guide to making schools more environmentally sustainable by involving the whole school community.

You can follow the course at your own pace. We will open one module at the beginning of each week, and there are only a few deadlines you need to pay attention to (those for the quizzes and/or the peer-review activity).

Join us in the [Facebook group](#) or share your thoughts on X (formerly Twitter) using the hashtag [#Bieconomy4Educators](#).

1. Learning objectives

- Define the concept of bioeconomy and explain its relevance for students and modern society by analysing the implications of bioeconomy for educational systems and curricula.
- Identify the tools and replicable practices and how to effectively utilise them in specific classroom settings by exploring GenB Toolkits.
- Discover sustainable practices and opportunities to transform the school into an environmentally aware institution by engaging with the 7-step Eco School Methodology.
- Design and implement lesson plans that incorporate bioeconomy principles in various educational subjects.
- Develop strategies to introduce and discuss career opportunities in the bioeconomy sector with students by analysing the sector and career testimonials from professionals in the field.
- Describe the goals and initiatives of the GenB project and evaluate its potential to enhance teaching methodologies.

2. Prerequisites

The course is aimed at practicing teachers with all levels of experience and across all subject areas, as well as student teachers preparing for entry into the profession. It also appeals to other educational professionals, researchers and bioeconomy stakeholders interested in implementing the topic of bioeconomy into their actions. No previous experience or knowledge about bioeconomy is needed to take this course.

3. Modules

- Module 1: Bioeconomy – from B to Y *opens on 14/10/2024*
- Module 2: Bioeconomy in Education: Best Practices and Challenges *opens on 21/10/2024*
- Module 3: Bioeconomy Career Awareness and Teaching Approaches *opens on 28/10/2024*
- Module 4: Your bioeconomy learning scenario *opens on 04/11/2024*

4. Behind the course

This MOOC has been developed as part of the [GenB project](#), funded by Horizon Europe, the European Union's funding programme for research and innovation, that runs from November 2022 until April 2025. It is focused on educating and empowering the Generation Bioeconomy (GenB), aware, sensitive, and interested in environmental issues, sustainability and circularity. It aims to raise awareness on Bioeconomy building on communication and education that

encourage and reward young BIOVOICES to take a role in steering the transition towards more sustainable lifestyles.

Scientix[®], the community for science education in Europe, promotes and supports a Europe-wide collaboration among STEM teachers, education researchers, policymakers and other STEM education professionals. Scientix[®] is an initiative of European Schoolnet (EUN).

2 Module 1: Bioeconomy – from B to Y

2.0. Module introduction







2.0.1. About this module

Welcome to the GenB MOOC: ‘Bioeconomy for Educators: Cultivating a Sustainable Future’!



During this module, you will discover the basic concepts of bioeconomy, such as linear and circular economy, biomass, bio-based materials and solutions and how they connect to the SDGs. In addition, together we will explore the presence of bioeconomy in everyday life and school settings, as well as controversial aspects of bioeconomy (e.g. greenwashing) and the building of sustainable habits.

By the end of this module, you will be able to

-  Define the terms bioeconomy and circular economy and how they differ from linear economy by reviewing state-of-the-art knowledge about the two concepts.
-  Explain key bioeconomy terms and concepts, by reviewing state of the field and future developments.
-  Explore and understand what biorefineries are, what processes take place in these facilities and their importance in the transition to more sustainable production by engaging with materials produced in collaboration with representatives of a biorefinery.
-  Discover biobased products and sustainable practices relevant to the lives of your students by reviewing products and practices they encounter in their daily lives.
-  Explore misconceptions and greenwashing practices in everyday life and marketing, to raise awareness of students and help them critically navigate the market.
-  Become familiar with the Learning Scenario template.

Before you continue with the course don't forget to:



- Fill in [the GenB project questionnaire](#)
- Join our [Facebook group](#) and use the hashtag **#Bioeconomy4Educators** to share ideas, thoughts and experiences on X and Instagram.

Ready to start? Click on “Next” and have a look on how to participate in this MOOC

2.0.2. Activity: Introduce yourself

Welcome to the GenB MOOC: ‘Bioeconomy for Educators: Cultivating a Sustainable Future’ Padlet

To start building our community, please find an everyday object you use that could be replaced with a bio-based alternative (e.g., plastic water bottles, traditional cotton clothing, non-biodegradable packaging). Take a picture of the object and post it on the designated Padlet. Along with the picture, please include:

1. Your **name and a brief introduction** (e.g., where you teach, your subject area, and your interest in bioeconomy).
2. A short explanation of **why you chose this object** and a potential **bio-based alternative** that could replace it. Please specify the material this new alternative is made of.
3. Don't forget to follow up by **replying to at least two colleagues** (other participants in the course) by sharing your thoughts on the items they shared, the schools or subjects they teach, their specific interest in the topic etc.

Ready to start? Click on the [Padlet](#) link below and introduce yourself!

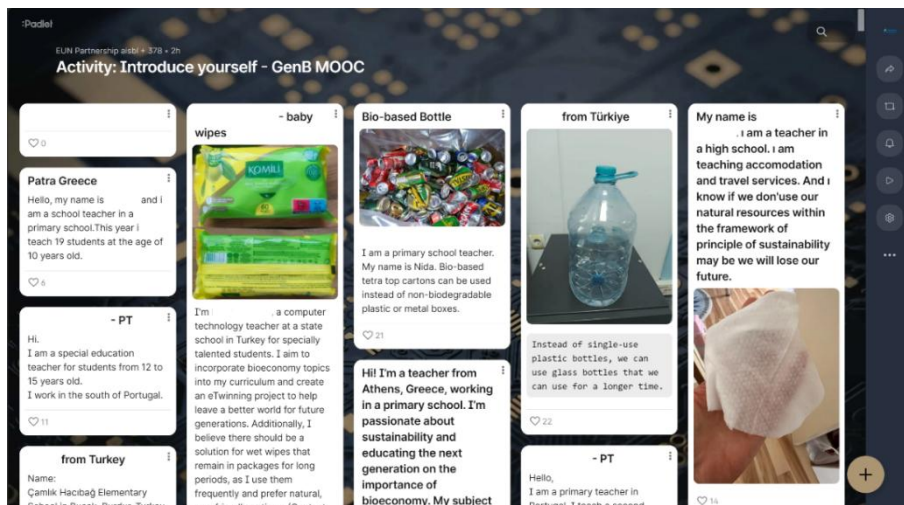


Figure 2. Padlet: <https://padlet.com/eunacademy/activity-introduce-yourself-genb-mooc-9spy7qphwfv70wy>

2.1. What is bioeconomy?

2.1.1. Activity: What do you know

To get started, we will begin with a quiz to assess your current understanding of bioeconomy concepts. This activity will help you identify what you already know and what areas you might need to focus on as we move forward.

Below you will find a quiz developed by the GenB project, which is a part of the GenB Toolkit for teachers. If you wish to use the material in your lesson [you can find it at the following link.](#)

Click on the 'Show answer' button after having submitted your answer for an explanation and more information.

1. Bioeconomy...

- A) Contributes to the reduction of CO₂ emissions
- B) Reuses waste to produce new materials and energy
- C) Creates new jobs
- D) All of them

Explanation: The shift to bioeconomy, not only contributes to reducing CO₂ emissions and reusing waste materials but also generates employment in both urban and rural areas.)

2. In what areas does the bioeconomy work?

- A) Agriculture
- B) Production and manufacturing
- C) Forestry and fishing
- D) All of them

Explanation: Bioeconomy refers to the production of renewable biological resources and their transformation into value-added products. The bioeconomy operates across agriculture, production and manufacturing, forestry, and fishing sectors, integrating sustainability into these areas.

3. Which of these processes optimises resources for the bioeconomy?

- A) Simply disposing of waste in landfills
- B) Processing residues or by-products into raw materials
- C) Burning all waste materials
- D) Avoiding the generation of waste altogether

Explanation: Processing residues or by-products into raw materials helps optimise the use and distribution of resources in the cycle of bioeconomy, allowing the development of biomass.

4. Why do we use renewable energy in the bioeconomy?

- A) To use up non-renewable resources
- B) To reduce fossil fuel use and support sustainability
- C) To ignore environmental issues in energy production

Explanation: Transitioning to a bio-based economy brings various advantages, such as reducing greenhouse gas emissions, diminishing reliance on fossil resources and better management of natural resources.

5. Which of the following is an example of a green job?
- A) Coal miner
 - B) Solar panel installer
 - C) Oil rig worker
 - D) Plastic factory worker

Explanation: A solar panel installer is considered a green job because it contributes to the production of renewable energy, reducing dependence on fossil fuels and promoting environmental sustainability.

6. Why do non-biodegradable materials, like plastics, pose long-term environmental risks?
- A) They decompose quickly but leave harmful residues
 - B) They are easily absorbed by natural processes
 - C) They persist for a long time and can harm ecosystems and wildlife
 - D) They break down into harmless substances that benefit the environment

Explanation: Non-biodegradable materials like plastics pose long-term environmental risks because they persist in the environment for extended periods, accumulating in ecosystems and harming wildlife.

7. Which of the following statements about composting is true?
- A) Composting involves burning organic waste to generate energy
 - B) Composting converts organic waste and improves soil quality
 - C) Composting is a method for recycling plastics
 - D) All of them are true

Explanation: Composting is a process that converts organic waste into nutrient-rich material, improving soil quality and promoting sustainable waste management.

8. What does biodegradation refer to?
- A) Burning organic waste to make energy
 - B) Making new materials with chemicals
 - C) Recycling plastics using machines
 - D) Microorganisms breaking down organic materials

Explanation: Biodegradation refers to the natural process in which microorganisms break down organic materials into simpler substances, promoting environmental sustainability.

9. Why do non-biodegradable materials, like plastics, pose long-term environmental risks?
- A) They decompose quickly but leave harmful residues
 - B) They are easily absorbed by natural processes
 - C) They persist for a long time and can harm ecosystems and wildlife
 - D) They break down into harmless substances that benefit the environment

Explanation: Non-biodegradable materials persist in the environment for extended periods, accumulating and potentially harming ecosystems and wildlife.

10. What is an important feature of non-renewable energy sources?

- A) They are always being made by nature
- B) They don't harm the environment much
- C) They can be used forever without running out
- D) They will run out because they can't be replaced quickly

Explanation: Non-renewable energy sources will eventually run out because they cannot be replenished as quickly compared to renewable sources.

Answer Key: D, D, B, B, B, B, B, B, C, B, D, C, D.

2.1.2. Defining bioeconomy

Bioeconomy is an economic system that uses **biomass** – renewable biological resources, such as plants, animals, and microorganisms – to produce goods, energy, and services. It is an alternative to fossil-based production processes as it mainly focuses on replacing fossil fuels in combustion and the production of materials with renewable biomass.

To support this shift, it's essential to increase the availability of biomass, which involves not only cultivating more plants but also utilising a diverse range of biological resources, including animal by-products and microbial processes. These efforts aim to enhance yields, ensure that these resources do not compete with food production, and optimise the collection and conversion processes to use all components effectively and sustainably.

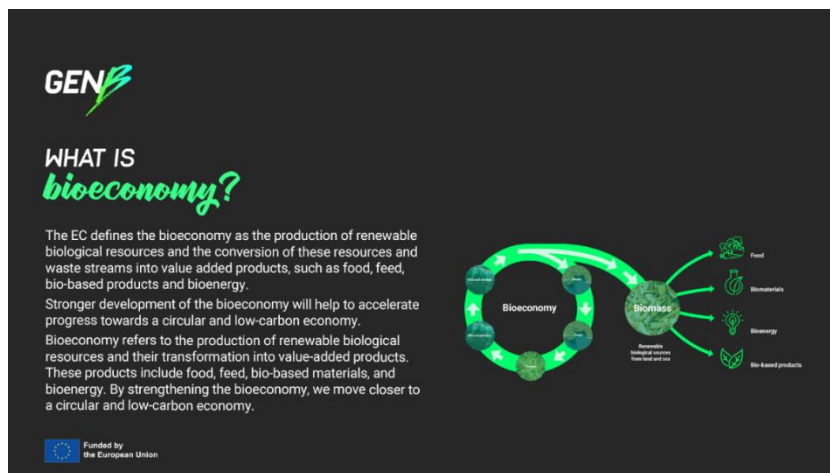


Figure 3. Bioeconomy Educational Cards, GenB Project, <https://library.qenb-project.eu/VLToolkit?id=a03Sf000007HCNUIA4>

It covers a broad range of sectors, from agriculture, fishery, and forestry to bio-based and traditional industries, biorefineries, and (bio) energy. It encompasses all sectors and associated services and investments, that produce, use, process, distribute or consume biological resources, including ecosystem services.



Figure 4. Bioeconomy Educational Cards, GenB Project, <https://library.genb-project.eu/VLToolkit?id=a03Sf000007HTZUIA4>

Video: What is Bioeconomy?

Watch this informative video from the GenB Ambassadors that explores the concept of bioeconomy, its applications, and its importance in sustainable development. Learn how bioeconomy initiatives are shaping various sectors towards a more sustainable future.

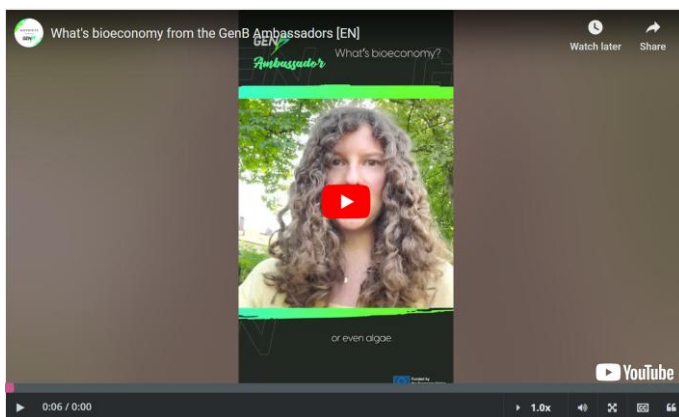


Figure 5. Video: BIOVOICES Project. (2024, July 9). What's bioeconomy from the GenB Ambassadors [Video]. YouTube. https://www.youtube.com/watch?v=i5_8JcMGwe0

Task: Explore and Share



Explore real-world examples of bioeconomy applications across different sectors. Share one interesting finding in the discussion below, discussing its impact and potential.

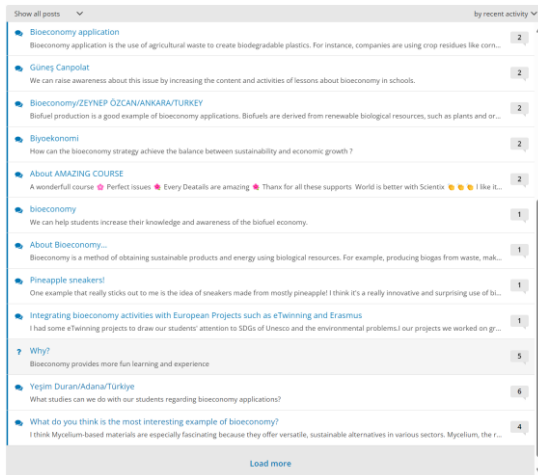


Figure 6. See all posts and participate in the discussion through the link:

<https://apps.europeanschoolnetacademy.eu/discussions/course-v1:GenB+Bieconomy4Educators+2024/posts>

2.1.3. Circular vs Linear economy

Let's talk about different economic systems: linear economy, circular economy and circular bioeconomy.

The linear economy follows the "**take-make-dispose**" model, where a product is bought, used, and discarded. However, this approach leads to significant problems:

- Depletion of natural resources
- Environmental pollution
- Climate change
- Damage to ecosystems and biodiversity
- Economic disadvantages

The circular economy follows a "**make-use-return**" approach based on closed loops, where raw materials, components, and products retain their value for as long as possible. The emphasis is on **designing products for durability, reusability, and recyclability**. After use, products are recycled, repaired, or repurposed, thereby minimising waste. In a circular economy:

- **Waste is minimised** by designing products for durability, reuse, and recyclability, keeping materials in circulation longer.
- **Natural resources are conserved** by reducing the need for new raw materials through efficient use and reuse.
- **Pollution is reduced** by lowering waste and emissions at every stage of the product lifecycle.
- **Raw materials are used to create high-value products** by maximising resource efficiency and ensuring materials can be continuously recycled or repurposed.

Video: This video explores how we can re-design the way our economy works - designing products that can be 'made to be made again' and powering the system with renewable

energy. It questions whether we can build a restorative economy, with creativity and innovation.



Figure 7. Video: Ellen MacArthur Foundation. (n.d.). Explaining the Circular Economy and How Society Can Re-Think Progress | Animated Video Essay [Video]. YouTube. <http://www.youtube.com/watch?v=zCRKvDyyHmI>

A **circular bioeconomy** is an economy based on bioeconomy however it incorporates the principles of circularity. In this system, **natural resources**—derived from both land and marine ecosystems—are **reused, recycled, and regenerated** in a **closed-loop, circular** manner. It aims to minimise waste and environmental impact by **constantly reusing and recycling natural materials**, by integrating scientific advancements and technological innovations, while, fostering a more sustainable and regenerative approach to production. Primary production sectors, such as agriculture, forestry, and fisheries play a central role, utilising practices that prioritise sustainability, biodiversity, and ecosystem health. Rather than depleting natural resources, this model emphasises prolonged use and recovery of materials, reducing emissions and promoting environmental restoration.

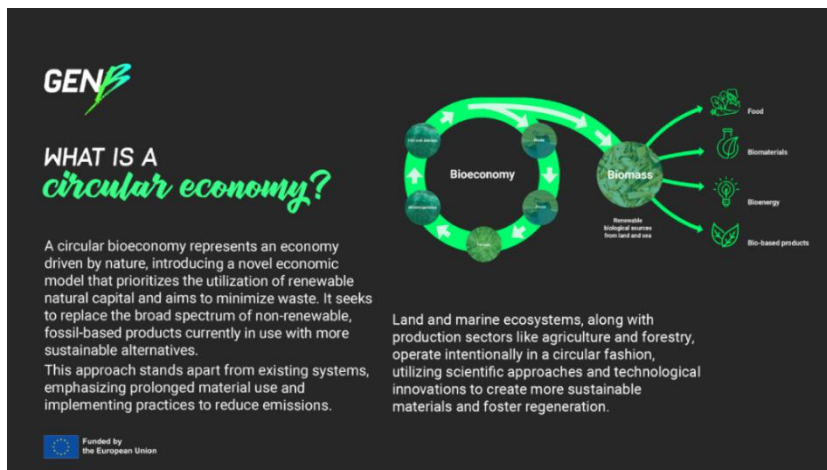


Figure 8. Bioeconomy Educational cards, GenB Project, <https://library.genb-project.eu/VLToolkit?id=a03Sf000007HORoIAO>

2.1.4. Activity – Circular economy

Discussion

Please, share your thoughts on each of the following questions in the [Padlet](#) wall:

- What are the implications of the linear economy on our environment?
- How does the circular economy address the challenges presented by the linear model?
- Can you provide examples of how schools can implement circular economy principles?

The screenshot shows a Padlet board titled "Activity - Circular economy". It contains several student contributions:

- Mihaela, France:** Products and materials are generally not used to their full potential in a linear economy and, as the name suggests, always move in one direction - from raw material to waste - a polluting system that degrades natural systems and is at the root of global challenges such as climate change and biodiversity loss.
- Linear Economy:** The linear economy relies heavily on finite natural resources. This means that raw materials are continuously extracted from the earth, leading to the depletion of these resources over time.
- merve çetin toptaş - mersin turkey:** The linear economy is based on the extraction, use, and disposal of resources. This model leads to resource depletion, environmental pollution, and disruption of ecosystem balance. The lack of
- Isabel Gejo-Santos, Salamanca, Spain:** Includes a diagram of the circular economy cycle: Make -> Use -> Repair -> Recycle -> Make. Text: "The circular model is in favour of using less raw materials and use more recycled inputs. Production has as little impact as possible on the environment by leaving less of a footprint. To make it sustainable, it should consider these three principles: reuse, reduce & recycle. Production should keep energy consumption to a minimum, and use renewable sources and non-polluting raw materials. Products should not have limited shelf life and be made so they can be repaired or recycled. The circular economy targets sustainability instead of profitability (as in linear economy). Finally, the circular economy might boost competitiveness, innovation, creation of new jobs and economic growth."
- Hüseyin SİHAT - TÜRKİYE:** We can benefit from the power of families by using their personal access and current positions. In this context, we can create a sustainable structure by including different sectors and expertise.
- Arnaud, France:** Compost canteen waste and then use the compost to feed a garden in which plants and vegetables would grow to feed the school's pupils (or even more).
- Hector, Spain:** We can implement circular economy principles by recycling programs or repairing broken items.
- Schools can set up recycling and composting programs, encourage reusable materials, and integrate sustainability into the curriculum.**

Figure 9. Padlet: <https://padlet.com/eunacademy/activity-circular-economy-fkyk75xpcy1rp84q>

2.2. Societal innovation in bioeconomy

2.2.1. Glossary of bioeconomy

Welcome to the Glossary of Bioeconomy! This page will introduce you to key terms and concepts essential for understanding bioeconomy principles. Explore the GenB Educational Cards for visual representations of these terms:

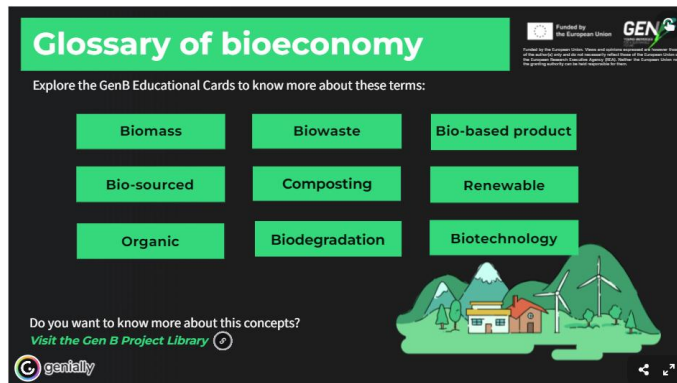


Figure 10. Glossary of bioeconomy, GenB Project,

<https://view.genially.com/665066497ceba60014a61237/interactive-content-glossary-of-bioeconomy>

Access the interactive visual through the link:

<https://view.genially.com/665066497ceba60014a61237/interactive-content-glossary-of-bioeconomy>

Let's learn about the sustainable and circular bioeconomy with the [GenB Educational Cards here](#).

2.2.2. Bioeconomy and challenges for sustainability

Do you know about the SDG?

The **UN Sustainable Development Goals (SDGs)** are a set of **17** interconnected **global goals** adopted by all United Nations Member States in 2015 as part of the **2030 Agenda for Sustainable Development**. They provide a framework for countries and organizations to work collaboratively towards a sustainable future, addressing issues such as poverty, inequality, climate change, environmental degradation, peace, and justice.

[Read more about them here.](#)

Bioeconomy, Climate Change and the SDGs

The following presentation explores the pivotal role of bioeconomy in addressing global challenges, particularly its impact on mitigating climate change and contributing to the SDGs.



Figure 11. PowerPoint Presentation: Bioeconomy and challenges for sustainability, GenB Project

Explore the presentation through the link: [1.2 Societal innovation in bioeconomy | Module 1: Bioeconomy – from B to Y | Bioeconomy for Educators: Cultivating a Sustainable Future | European Schoolnet Academy](#)

When teaching about SDGs and bioeconomy in your classroom consider incorporating board games to make the lesson interactive and engaging: [“BE-Match” and “SDG-Link” Games.](#)

The purpose of these games is to introduce various bio-based products that can substitute traditional products in our daily lives and inspire the limitless possibilities enabled by the bioeconomy industry. The activities also encourage discussion on the links between bio-products and the UN Sustainable Development Goals (SDGs). Students could play the BE-Match game first, followed by the SDG-Link game, either on the same day or on different days. Both games take about 15 to 30 minutes, and no prior knowledge of bioeconomy is required to participate. They can serve as a warm-up activity for introducing secondary education students to a bioeconomy lesson plan or as a means of spreading general knowledge about the topic.

Additionally, you can discover innovative bio-based products and learn how the bioeconomy can contribute to achieving Sustainable Development Goals (SDGs) by visiting this virtual store: [Virtual Bio-based Pop-up Store.](#)

2.2.3. Bioeconomy and energy needs

A **renewable resource** is a material, energy, or water source that is never used up or that can be replaced by new growth within a human timescale. Unlike fossil fuels, which can take millions of years to form, renewable resources can quickly regenerate and are continually available. Bioenergy can be generated using several feedstocks, including purposely grown crops and biowaste.

A wide range of **biomass feedstocks**, including purposely grown crops (e.g. on marginal or polluted lands) and waste materials (e.g. agricultural waste; tree pruning; used cooking oil) **can be used to produce different forms of bioenergy**, such as heat, electricity, and solid/liquid/gaseous biofuels (e.g. pellets, bioethanol, biogas).

How can we further use renewable resources more efficiently to replace traditional, polluting energy sources like coal, petroleum oil, and gas? Explore the Genially board to learn more

through the link: <https://view.genially.com/66f6d5dc9b9c4de02a82213a/interactive-content-bioeconomy-and-energy>

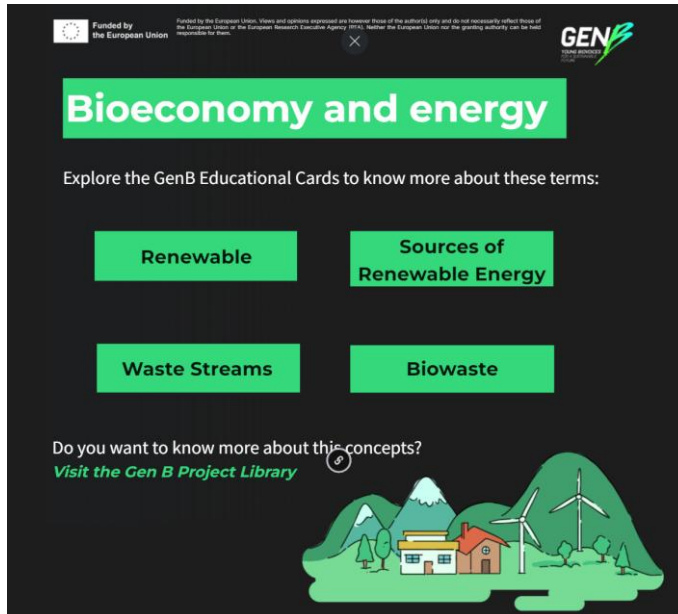


Figure 12. Interactive infographic: Bioeconomy and energy, GenB Project, <https://view.genially.com/66f6d5dc9b9c4de02a82213a/interactive-content-bioeconomy-and-energy>

Currently, the most widely used substitute for fossil fuels is biofuels. **Biofuels**, such as biodiesel and bioethanol, are produced from **renewable organic materials** (biomass) like plants and agricultural waste. They are a more sustainable alternative to traditional fossil fuels because they emit fewer greenhouse gases, which can help reduce dependence on fossil fuels and mitigate the effects of climate change.

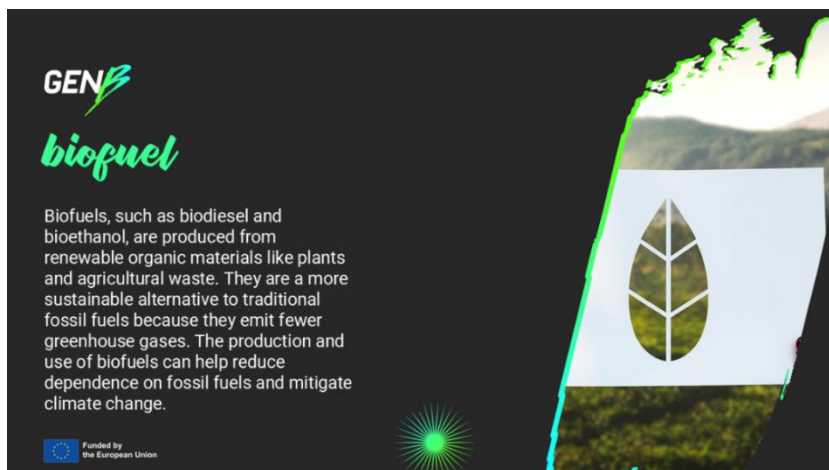


Figure 13. Bioeconomy Educational Cards, <https://library.genb-project.eu/VLToolkit?id=a03Sf00000CttzXIAR>

Biofuels can be categorised into three types:

- **Solid biofuels** – biofuels from non-fossil material of biological origin (biomass), used for heat production or electricity generation.

E.g.: fuelwood, wood residues, wood pellets, animal waste, vegetal material, ...

- **Liquid biofuels** – includes all liquid fuels produced from biomass or biodegradable fractions of waste, suitable for blending with or replacing fossil-based liquid fuels.

E.g.: bio gasoline, biodiesel, bio jet kerosene, ...

- **Biogases** – consist primarily of methane and carbon dioxide, produced through anaerobic digestion.

E.g.: landfill gas, sewage sludge gas digester gas..

(Source: Eurostat Glossary: [Biofuels](#))

Biofuels offer several advantages:

- **They produce fewer greenhouse gas emissions than fossil fuels, helping to reduce carbon pollution.**
- Using locally made biofuels also boosts energy security by lessening dependence on imported oil.
- Biofuel production creates jobs in farming, manufacturing, and distribution.
- Plus, converting waste into biofuels helps manage waste and reduces the need for landfills.

Bioeconomy and biofuels play a critical role in creating sustainable energy solutions and reducing environmental impact.

2.2.4. Biorefinery

Have you ever come across the term "biorefinery" before?

Biorefining is the sustainable processing of biomass into a spectrum of bio-based products (food, feed, chemicals, materials) and bioenergy (biofuels, power and/or heat). This concept is comparable to today's petroleum refinery, which produces multiple fuels and products from petroleum oil.

Biorefineries are facilities that use biomass as feedstocks, such as residues from agriculture, forestry, dedicated energy crops, and organic waste and transform them into a wide range of bio-based products and bioenergy.

Tanja Meyer and Zsófia Kádár, representatives of BBEPP (Bio Base Europe Pilot Plant). Teachers explored about biorefineries, their operations and their critical role in advancing sustainable energy production. For more information about the work of BBEPP visit their YouTube channel:

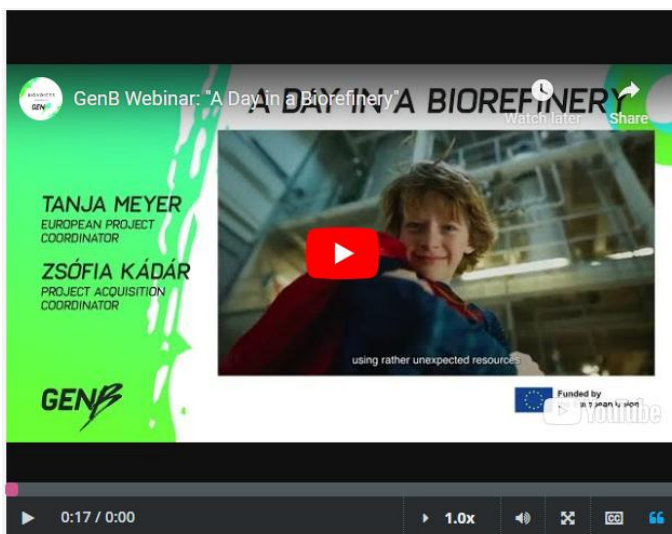


Figure 14. Video: BIOVOICES Projet. (2024). GenB webinar: A day in a biorefinery [Video]. YouTube.
https://www.youtube.com/watch?v=j6Zm46s_hMI

Watch the recording of the webinar session 'A day in biorefinery' with Tanja Meyer and Zsófia Kádár, representatives of BBEPP (Bio Base Europe Pilot Plant). Teachers explored about biorefineries, their operations and their critical role in advancing sustainable energy production. For more information about the work of BBEPP [visit their YouTube channel](#).

Processes taking place in the facilities

But what happens inside a biorefinery? What processes allow this facility to transform biological materials into valuable products? In a simplified way and just as an example, biorefineries process biomass by separating it into components, breaking them down into sugars, converting sugars into products like ethanol, purifying these products, using them to make fuels, chemicals, and other materials.

Explore the different concepts in the following infographic to know more details:

<https://view.genially.com/669a23a9b1ed32a359781c10/interactive-content-biorefinery>

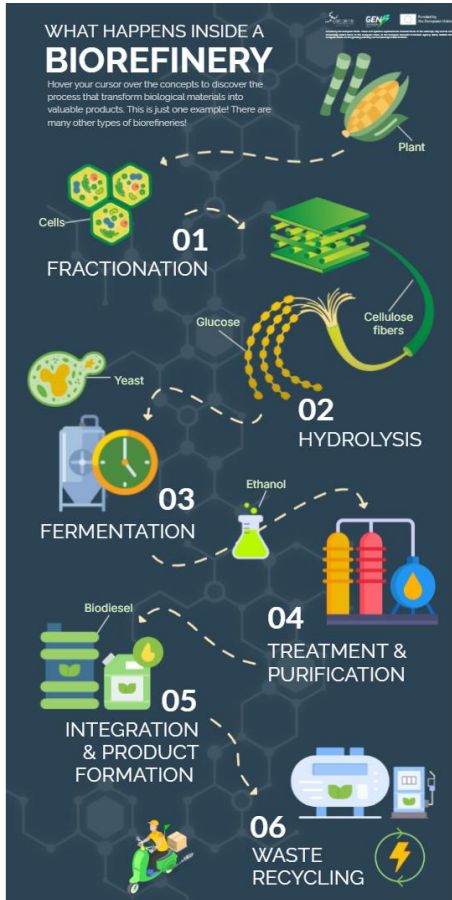


Figure 15. Interactive infographic: What happens inside a biorefinery?, GenB Project, <https://view.genially.com/669a23a9b1ed32a359781c10/interactive-content-biorefinery>

To learn more about the production and utilisation of bio-based materials, with a focus on the transformation of biomass into innovative products, take a look at this webinar session with EU Bioeconomy Youth Ambassadors, Stefano Bertacchi, PhD and Katrin Jögi.



Figure 16. Video: BIOVOICES Project. (2024). Exploring Careers in Bio-based Materials: From Production to Utilization [Video]. YouTube. <https://www.youtube.com/watch?v=1u0-r7Cw4DI&t=1s>

2.2.5. Activity - Products of a biorefinery

Do you know what the most common products obtained from biorefineries are nowadays?
Match the two columns and find out some examples!

PROBLEM

Match the two columns and find out some examples!

Protein-rich meal from soybean processing for livestock nutrition.	Lactic acid is used for biodegradable plastics in eco-friendly packaging.	Artemisinin, a bioactive compound extracted from the sweet wormwood plant, is processed to treat malaria.			
Enzymes used in laundry detergents to improve cleaning efficiency.	Fibreboards made from agricultural residues, used for home and office insulation.	Ethanol from corn, blended with gasoline to reduce fossil fuel use in vehicles			
Biofuels and Bioenergy.	Chemicals products and materials	Sustainable building materials.	High-value products.	Animal feed products.	Pharmaceuticals.

Figure 17. Drag and Drop Activity

Answer Key: Biofuels and Bioenergy. → Ethanol from corn, blended with gasoline to reduce fossil fuel use in vehicles.; **Chemicals products and materials** → Lactic acid is used for biodegradable plastics in eco-friendly packaging.; **Sustainable building materials.** → Fibreboards made from agricultural residues, used for home and office insulation.; **High-value products.** → Enzymes used in laundry detergents to improve cleaning efficiency.; **Animal feed products.** → Protein-rich meal from soybean processing for livestock nutrition.; **Pharmaceuticals.** → Artemisinin, a bioactive compound extracted from the sweet wormwood plant, is processed to treat malaria.

2.2.6. Activity: Share your reflections

This activity is designed to help you reflect on the bioeconomy terms and concepts introduced so far, particularly focusing on biorefineries.

Please follow the instructions below to participate.

- Review the bioeconomy terms and concepts introduced in this module and reflect:
 - a. Reflect upon the terms presented so far, which terms were you unfamiliar with?
 - b. Which terms do you find easier to teach in your classroom? And which ones do you find more challenging?
- Share your experience:
 - a. Have you ever taught any of the concepts related to bioeconomy or biorefineries?
 - b. If yes, how did you approach teaching these concepts and what specific aspects or topics did you focus on?
 - c. How can we awaken curiosity and draw the attention of our pupils to this issue?
- Post on Padlet:
 - a. Create a post where you share these reflections and experiences.
 - b. Feel free to include any challenges or successes you've encountered while teaching these concepts.

This activity is a great opportunity to engage with fellow educators, share insights, and learn from each other's experiences.

Let's start reflecting and sharing on the [Padlet!](#)

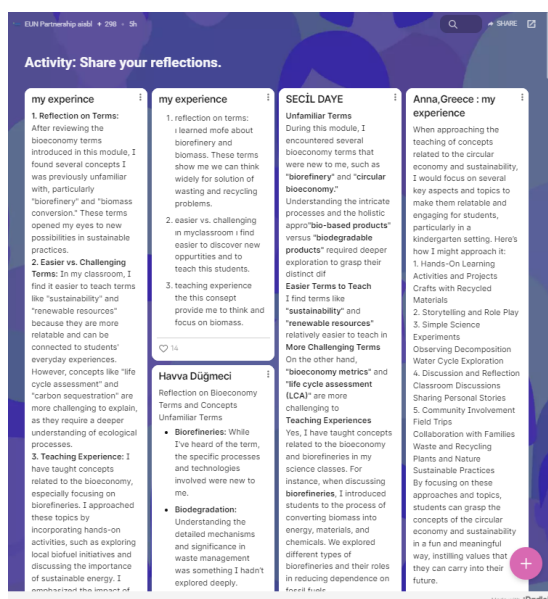


Figure 18. Padlet: <https://padlet.com/eunacademy/activity-share-your-reflections-mvqu72a8k36bm5z5>

2.3. Bioeconomy in everyday life

2.3.1. Bio-based products in everyday life

The focus of this unit is to raise awareness of the presence of bioeconomy in different forms in our everyday lives, very often without realising it.

While at first glance, the full transition to bioeconomy might seem far in the future or that it does not depend on us, it is already here and happening.

Explore the different bio-based products to learn more about their production, in the following infographic: <https://view.genially.com/66f6c836b68a4f395e820d25/interactive-content-bioproducts>

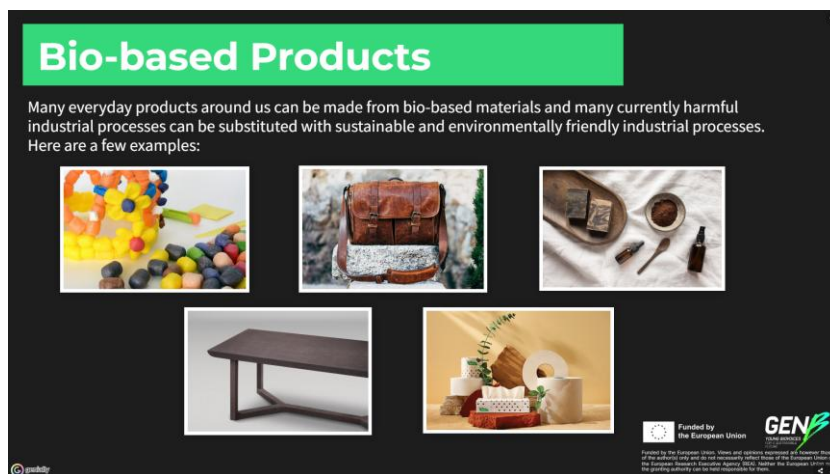


Figure 19. Interactive infographic, GenB Project, <https://view.genially.com/66f6c836b68a4f395e820d25/interactive-content-bioproducts>

However, several challenges need to be addressed for these bio-based solutions to become mainstream. For instance, the cost and scalability of producing sugarcane-based plastics and other biomaterials can be higher compared to traditional plastics, limiting their widespread adoption.

Leather alternatives like mycelium and olive leaf-tanned leather may face hurdles related to production scale and consumer acceptance. Coffee residue tables and other products often require new processing technologies and market infrastructure, which can be costly and complex to develop. In the cosmetic sector, bio-based ingredients may face challenges related to cost, efficacy, and consumer perception. Sustainable paper products, while promising, often need advancements in processing technologies and consumer awareness to compete with traditional paper products. Overcoming these challenges requires continued research, investment, and collaboration across industries to make bio-based products more accessible and affordable.

To learn more about bio-based products and to inform your students about more sustainable options of different products they use in daily life, you can find another collection of [57 factsheets on Bio-based products in various languages for educational purposes.](#)

2.3.2. Where to find bio-based products?

Is it possible to adopt a more sustainable lifestyle? In this video, they tried to imagine a day in which many fossil-based products can be replaced by bio-based products.



Figure 20. BioBridges project (2020). Bio-based day. [Video]. YouTube.

https://www.youtube.com/watch?v=6f7Ej2_BLso&list=PLtcmfwGu2PB3NdW5cwMb2ciiOdfyVtvvL

Find out about other bio-based materials and what they are made of by watching a series of GenB educational videos. The videos feature one bio-based product such as a make-up glove, and multiple-choice questions about the material the product is made of. Videos could be used for summative assessment of students.



[Check out the videos.](#)

If you would like to learn more about bio-based products you can take a look at the materials in the list below. You can use the materials to support your lessons as well as raise awareness of students to the available sustainable options.

- Under the title **Bio Art Gallery**, the BIOVOICES project published a [catalogue presenting 60 artistic pictures that associate commonly known feedstock](#) (tomatoes, coffee, apples, oranges, etc.) with their surprising bio-based applications.
- The promotional video **A Bio-Based Day**, produced by the BIOBRIDGES project, follows a young lady during her bio-based day, from the wake up to the goodnight, discovering how bio-based products can substitute fossil-based ones in every day's lives.
- In the publication **A journey to the bioeconomy future** the BLOOM project packed a suitcase with bio-based products. The suitcase contains items that look and feel like the products we have been using for years, except that they are slightly different: they don't harm the environment.
- BioStep, **Bioeconomy in everyday life**,
- The BBI JU brochure "**Bio-based industries made for European citizens**" presents showcases of bio-based products in our everyday life, including new and innovative solutions for renewable raw materials and waste – clothes made of milk waste, cups made of used coffee waste, rackets made of flax fibres, dandelion sap turned into tyres...

2.3.3. Misconceptions about bioeconomy

You have probably seen slogans like “eco-friendly”, “bio” and “green” in products at supermarkets and stores. However, are these products genuinely good for the environment? Can we trust these labels? Are bio-products always the best option?

Let’s find some answers to such questions in the following presentation through the link: [1.3 Bioeconomy in everyday life | Module 1: Bioeconomy – from B to Y | Bioeconomy for Educators: Cultivating a Sustainable Future | European Schoolnet Academy](#)



Figure 21. PowerPoint Presentation: Bioeconomy and controversial issues, GenB Project

2.3.4. Activity: Detecting fakes

Have you ever wondered if the "eco-friendly" products you buy are genuinely good for the environment?

Do you trust the environmental claims made by companies, or do you think greenwashing is a widespread problem?

In this activity, you will learn how to evaluate the truth behind "green" or "eco-friendly" claims on products and reinforce the concept of greenwashing.

Steps:

1. Select and Examine a Product:

- Pick a product with a “green” or “eco-friendly” label you’re your home (e.g., cleaning items, food, clothing).
- Write down its name, brand, and eco-friendly claims on the packaging.

2. Research:

- Company Info: Look up the company online and visit their website for details on their sustainability practices.
- Certifications: Check if the product has official eco-friendly certifications, like: EU Ecolabel, Global Organic Textile Standard (GOTS); Forest Stewardship Council (FSC); etc.
- Ingredients/Materials: Verify if the ingredients or materials used are truly eco-friendly (e.g., biodegradable, organic).

3. Evaluate Claims:

- Packaging: Is it recyclable or made from recycled materials?
- Production: Does the company mention using eco-friendly production methods (like renewable energy)?

4. Check for Greenwashing:

- Consistency: Are the eco-friendly claims consistent across the product, website, and ads?
- Proof: Find evidence or reviews that support the eco-friendly claims.

5. Discuss and Reflect:

- Did you initially trust the green claims?
- After researching, do you still believe them? Why or why not?
- Share your findings on our Padlet. with a photograph of the product itself!

This activity helps students critically analyse green claims and recognise when companies might be greenwashing. This understanding can help you make more informed, eco-friendly choices. Fill in the Padlet: <https://padlet.com/eunacademy/activity-detecting-fakes-4ndz1fr7gl27uu3j>

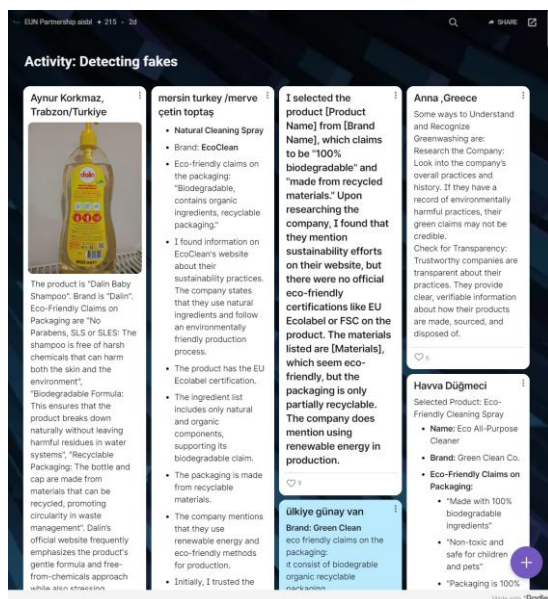


Figure 22. Padlet: <https://padlet.com/eunacademy/activity-detecting-fakes-4ndz1fr7gl27uu3j>

2.3.5. Activity: Share your experience

Share your experiences with bioeconomy in everyday life using Padlet. Address the following questions:

- What are the disadvantages of using bio-based products in everyday life?
- What activities or projects can we incorporate into the curriculum to help students critically evaluate bio-based products?
- How can we encourage students to think about sustainable alternatives and the complexity of making environmentally responsible choices?

You are invited to comment on the other participants' posts on the Padlet:
<https://padlet.com/eunacademy/activity-share-your-experience-fukzfnfi75g8yvk>



Figure 23. Padlet: <https://padlet.com/eunacademy/activity-share-your-experience-fukzfnfi75g8yvk>

2.3.6. You want to learn more?

In the following [video](#), Judith Feichtinger from ZSI who worked on the Transition2Bio project, answers some of the most frequently asked questions, some of which you will have already encountered during this module:

- How can we, as a society, treat natural resources sustainably and responsibly while also running a thriving economy?
- How does the circular economy work?
- Is there enough biomass for all biobased applications?
- Is biobased production competing with food production?
- Are biobased products degradable?
- What are the advantages of bioeconomy?



Figure 24. Transition2BIO - #1 Capacity Building for teachers; BIOVOICES project:
<https://www.youtube.com/watch?v=JPU0B1AJNmU>

Additional resources to teach about bioeconomy in your lessons:

- AIJU et al. (n.d.). Planet [Game, Spanish]. <https://files.eun.org/scientix/PLANET-PRINT-TO-PLAY.pdf>)
- (n.d.). What is bioeconomy? [Gamified book]. <https://library.genb-pzzzproject.eu/VLToolkit?id=a030900000TStfcAAD>
- GenB (2024). *Educational Cards*. https://genb-project.eu/genb_toolkit/bioeconomy-educational-cards/
- GenB (2024). *Educational Videos*. https://genb-project.eu/genb_toolkit/educational-videos-5/
- GenB (2024). *Bioeconomy Quiz*. https://genb-project.eu/genb_toolkit/bioeconomy-quiz/
- BIOVOICES Project (April 2024). *GenB Capacity Building Webinar with GenB Ambassadors - Basic Level 1* [Video]. <https://www.youtube.com/watch?v=7pzS7E5eF-Q>

2.4. Introduction to the peer activity

2.4.1. Bioeconomy Learning Scenario

GenB MOOC 'Bioeconomy for Educators: Cultivating a Sustainable Future' consists of four modules. To earn a course certificate, you need to complete all four modules, including passing all the quizzes and completing the final course activity at the end of Module 4. The final course activity in the "Boosting Bioeconomy Knowledge in Schools" MOOC is a peer-to-peer activity that consists of two parts:

Part 1: Work Submission

To get a course certificate, you will need to create and submit a Learning Scenario. Whilst you will be working on filling in the Learning Scenario throughout the whole MOOC, you will only have to submit it during the final activity, in Module 4. A **Learning Scenario** is a detailed description of an entire lesson, from beginning to end. Here you can find the Learning Scenario template that you are expected to follow. Your Learning Scenario has to be in English; otherwise, it will not qualify.



[Find here the GenB Learning Scenario template.](#)

To be complete, the Learning Scenario will have to be about the topic of bioeconomy.

You can work in pairs with another course participant. If you choose to do so, please make sure that:

- Each participant submits the Learning Scenario individually.
- Even though you are submitting the work individually, the Learning Scenario must have both authors' names on it.
- Both Learning Scenarios need to be identical, otherwise, it counts as s.

You can start filling the Learning Scenario template with some of your ideas!

And here's an extra splash of excitement: in February 2025, you will have the opportunity to participate with your Learning Scenario in the [2025 STEM Discovery Campaign!](#)

2.4.2. Fill in you GenB Learning Scenario

In this section, you'll be introduced to two example GenB Learning Scenarios designed for primary and secondary schools. These materials are drafts, and they haven't been tested yet. However, the teaching materials included in these scenarios have been validated.

2. [LS example for primary school teachers.](#)
3. [LS example for secondary school teachers.](#)

At this stage you will need to complete the following 5 categories:

- **Duration:** How long does the activity take? Does it require more than one session or class?
- **Type of activity:** You can adapt your activity to different teaching modalities: online (with everyone connecting from a different laptop), face-to-face (in a traditional setting with educator and students in the same place) or hybrid (with some students connecting online and some in the classroom). You can choose several formats so that the activity can be adapted to different modalities.

- **Indicated age group:** The activity can target one or several age groups: 4-8 years old, 9-13 years old, 14 to 19 years old. You can also design an activity aimed at adults: teacher training, an awareness-raising activity, or an activity for higher education, for example.
- **Introduction:** We invite you to describe the activity in detail, mentioning at least these elements: 1) 1 to 3 goals of the activity, 2) materials required, 3) a description of the steps to take and content of the activity, 4) optionally any formative assessment you would undertake.
- **Topics:** Select a few keywords to identify the main topics of the activity: bioeconomy, sustainability, circularity, greenwashing, biomass; biodegradability; environment.

2.4.3. Peer review activity

Part 2: Peer review

After submitting the Learning Scenario, you will move on to the second part of the peer-to-peer activity – the peer review. Each course participant will receive three other course participants' Learning Scenarios to review. To help you review the Learning Scenarios, we will provide you with a set of criteria to guide your review process.

It is recommended to take a look at the set of criteria before you start drafting your own Learning Scenario because you will be evaluated based on the same points during the review.



[Find the MOOC Rubric here.](#)

After you submit your Learning Scenario and review three other course participants' Learning Scenarios, you have successfully completed the final course activity, and you have earned the course certificate.

We encourage you to begin planning your own GenB Learning Scenario. In this unit, we ask you to think about which aspect of bioeconomy you would like to introduce to your students and what specific learning goals you have for them to achieve. You can start by answering these questions:

- Which area of bioeconomy would I like to introduce to my students in my Learning Scenario?
- What learning objectives do I aim for my students to achieve when developing my GenB Learning Scenario?

2.4. Live Events

2.4.1. Webinar with the Bioeconomy expert

Webinar: Educating for bioeconomy: from classroom to community

Date: **Thursday, 24 October, 17:00- 18:00 CET**

Recording:



Figure 25. European Schoolnet Academy (October 28, 2024). GenB MOOC - Webinar: Educating for bioeconomy from classroom to community [Video]. YouTube. <https://www.youtube.com/watch?v=LTfwGON3tZE>

You can [download the presentation here](#).

Join us for an engaging webinar focused on the impact of implementing living labs and collaborative events and activities on bioeconomy with the community in schools. Discover how these collaborative efforts have fostered connections between schools and the community, aiming to enhance the engagement of students in hands-on, real-life activities.

Don't miss this opportunity to contribute to the conversation on bioeconomy in education and learn how to strengthen your community ties!

Susanna Albertini



FVA New Media Design partner from 1995, she is involved in various EU-funded projects, supporting the awareness raising, communication, education and stakeholder engagement of the Sustainable Circular Bioeconomy, like GenB, BlueMissionMed, BioGov.Net, BIObec, GLAUKOS, Transition2BIO, BIOVOICES, BIOBRIDGES, LIFT and BIOWAYS. She is the promoter of the **European Bioeconomy Network**, an alliance of more than 160 EU-funded projects and initiatives in Bioeconomy and sustainability. Susanna is co-author of the book for kids "What's

bioeconomy" and she created various formats and tools to raise awareness and promote the bioeconomy, targeting various stakeholders, from the large public to policymakers.

During the Q&A session, we will gather valuable insights from teachers regarding the bioeconomy and explore ways to integrate this vital topic into the lessons.

Connection details



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These events will take place via Microsoft Teams meeting. You can join a Microsoft Teams meeting by using an invite link which will be shared with you before the event. You can then launch or download the Teams app, or simply join using your web browser (no download required). The easiest way is to join anonymously (no account or sign in required). Alternatively, if you have an educational license, you can sign into your Microsoft account. [Here](#), you can find more information on how to join a Microsoft Teams meeting. As an attendee of a meeting in Teams, you can watch live events and participate in the moderated Q&A, but you cannot share audio or video.

Before watching a live event, make sure your browser allows third-party cookies. You can ensure your browser supports [Microsoft Teams](#) and [Microsoft Azure Media Player](#).

Please note that this Microsoft Teams service allows audio and other information sent during the session to be recorded, which may be discoverable in a legal matter. By joining this session, you automatically consent to such recordings. If you do not consent to being recorded, discuss your concerns with the host or do not join the session.

The recording will be shared in the current section shortly after the event.

2.4.2. Activity: Ask the Speaker

As you already know, we are having a webinar with experts on how to include bioeconomy in the existing curricula, as well as how to build meaningful collaborations with different organisations in our community.

Before the webinar, we invite you to write down your questions for our guest speaker on the Padlet board embedded on this page. You'll also have the opportunity to vote for the questions you find most intriguing. Due to time limitations, the questions with the highest votes will be prioritised by the speaker to address during the webinar. The remaining questions will be responded to by the speaker in writing.

During the webinar session, our guest speaker will provide insightful answers to the selected questions, offering valuable perspectives on the topic. But don't hesitate to [ask your questions](#) yourself during the event too!

Ask your questions through the Padlet: <https://padlet.com/eunacademy/ask-the-speaker-5xi6lyz9w9nfv2me>

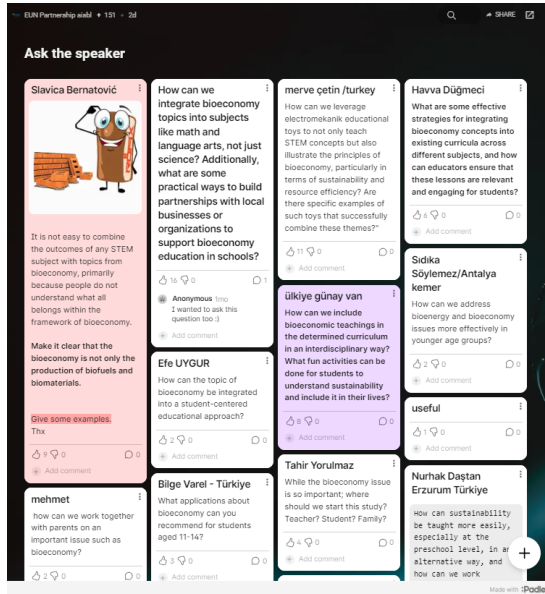


Figure 26. Padlet: <https://padlet.com/eunacademy/ask-the-speaker-5xi6lyz9w9nfv2me>

2.5. Module Round-up

2.5.1. Take Action!

Are you passionate about the environment and love expressing yourself through art? If you are a teacher or a youngster between 4 and 30 years old, here's your chance to make a difference, as single artist or engaging your entire school or class: [the GenB Bioeconomy Art Competition](#) is looking for you! Unleash your passion for art and nature!

Ever wondered how can we live more sustainably and protect our planet? The circular and sustainable bioeconomy plays a huge role in making this happen. It's all about using resources wisely, reducing and reusing waste, and finding new ways to live in harmony with nature. You have the power to drive this change. From making eco-friendly choices to raising awareness, every action counts. And guess what? Art can be a powerful tool in this movement too! It can inspire people, create emotional connections with the environment, and spread the message of sustainability in a way that everyone can understand.

The GenB Bioeconomy Art Competition is your chance to use your creativity to inspire others and make a difference.

For more information and [how to participate check out the competition guidelines.](#)

2.5.2. Module summary

In this module, you explored the exciting world of bioeconomy and how it impacts our daily lives. You learned about biorefineries and bio-based materials, seeing how things like bamboo toys and bricks grown by bacteria are making our world more sustainable.

You also did various activities that aimed to help you think critically about bio-based products and plan lessons for our students. These activities aimed to introduce you to the fundamentals of bioeconomy and provide you with the basic knowledge and tools to teach the topic effectively in your classrooms.

As you move forward, you will help you continue to explore and innovate, ensuring that you will be able to integrate these crucial concepts effectively into your teaching practices.

2.5.4. Module Round-up



Great work! We have made it through Module 1!



You have been presented with the definitions of the terms bioeconomy and circular economy and how they differ from linear economy by reviewing state-of-the-art knowledge about the two concepts.



You have been explained the key bioeconomy terms and concepts, equipping you with the knowledge to educate students on navigating and contributing to a sustainable future.



You have explored and familiarised yourself with what are biorefineries, what processes take place in these facilities and their importance in transition to more sustainable production by engaging with materials produced in collaboration with representatives of a biorefinery.

- ✔ You have discovered bio-based products and sustainable practices relevant to the lives of your students by reviewing products and practices they encounter in their daily life.
- ✔ You have explored misconceptions and greenwashing practices in everyday life and production, to raise awareness of students and help them critically navigating the market.
- ✔ You have become familiar with the Learning Scenario template.

Next module starts on Monday. Keep up the good work!

3 Module 2: Bioeconomy in education: Best practices and challenges

3.0. Module introduction

3.0.1. About this module







Welcome to Module 2!



In the previous module, you discovered what bioeconomy is, and how it affects the lives of your students. You have explored the vast number of bio-based products around us, addressed usual misconceptions and misuses of terminology and discussed the societal implications of bioeconomy. Lastly, you also learnt about the final course activity which you will develop by the end of this MOOC.

In Module 2 you will learn how to integrate bioeconomy in different subjects and will become familiar with the GenB Toolkit for teachers, a collection of learning and teaching materials, developed within the GenB project. In addition, you will be introduced to the 7-step Eco School methodology and teaching materials developed within different projects related to bioeconomy and explore how to effectively use it in your classrooms. These learning materials are not only useful because they can be easily used in your classroom, but also because they serve as an example of how to introduce bioeconomy in schools. Additionally, the Gen B toolkit uses the most recent educational methods, such as the whole school approach, hands-on learning and inquiry-based science education (IBSE), that you will also learn more about. Finally, we will have a webinar, where experts will share their experiences using and implementing bioeconomy in the classroom in collaboration with teachers.

In this module, you will:

-  Understand how to integrate the topic of bioeconomy into different subjects at different school levels by exploring GenB Toolkit.
-  Define the 21st Century skills and trends in the classroom and identify which specific skills can be developed by introducing students to the topic of bioeconomy and activities related to it.
-  Analyse different learning approaches and methodologies to most effectively introduce bioeconomy in your classroom by exploring the whole school approach, PBL, IBSE and more.
-  Explore the 7-step Eco-School methodology by investigating each step in detail, understanding its significance in promoting environmental sustainability, and implementing a school-wide eco-friendly project.
-  Explore the interdisciplinary approach and practice how to use it in your GenB Learning Scenario.
-  Participate in a debriefing webinar on the implementation of bioeconomy in the classroom with expert teachers.

Ready to start? Click on “Next”

3.1. How to talk about bioeconomy in education?

3.1.1. Making connections: What is the role of the Bioeconomy and Education?

By exploring Module 1 you had the chance to get to know more about the field of Bioeconomy and understand more its significance and the ever-evolving role that it plays in our lives. This has inspired a lot of global initiatives to promote awareness and apply bioeconomy principles.

As an examples of such initiatives, the EU has put in place a well-defined trajectory towards a more circular bioeconomy with its [Bioeconomy Strategy 2018](#). This strategy anticipates the creation of 1 million new jobs by 2030, showcasing the significant potential of the bioeconomy to drive economic growth and sustainability. A critical component of this vision is the role of **education** in preparing individuals and society to fully embrace and contribute to this evolving sector.

By reflecting on the reasons why **education is an important component of the bioeconomy** will also help you prepare for your roles as a teacher and educator. By ensuring that students get a quality education relevant to the field you are also helping them:

- Foster critical 21st century and 'green' skills to help them navigate complex bioeconomy challenges.
- Introduce students to emerging fields and evolving career opportunities in the field of bioeconomy to allow them to contribute to the cause in a meaningful way.
- Promote awareness that will give them the chance to participate in decision-making for matters related to bioeconomy.

For more information about this, delve deeper into the **EU Policy brief about promoting education, training, and skills across the bioeconomy**.

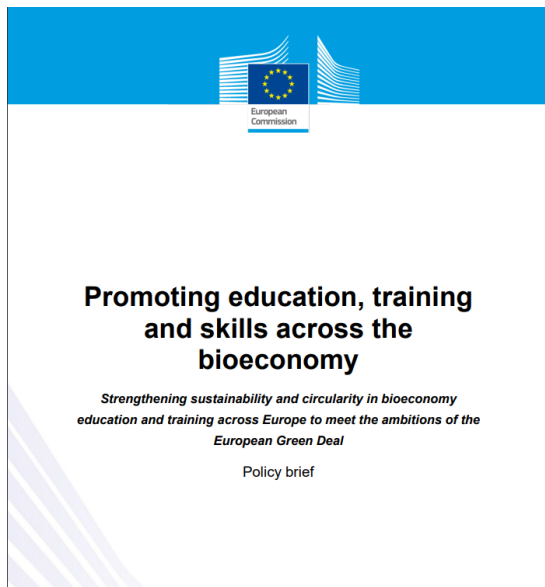


Figure 27. European Commission, Directorate-General for Research and Innovation, Graaf, I., Papadimitriou, A., & Peijl, S. (2022). Promoting education, training and skills across the bioeconomy: Policy brief. Publications Office of the European Union. <https://data.europa.eu/doi/10.2777/026558>

3.1.2. GenB Project

Understanding this important connection between education and bioeconomy, **GenB project** works towards educating and empowering students to become more aware, sensitive and interested in environmental issues, sustainability and circularity.

The project aims to help teachers, educators and other stakeholders understand what they need to do to **facilitate the creation of a Generation Bioeconomy (GenB)**.

GenB focuses on **students from early childhood education to secondary school (4–19-year-old students)** and its works towards providing formats, materials, toolkits and other teaching resources to introduce bioeconomy in the classroom, as well as provide policy recommendations for Ministries of Education to foster the inclusion of the topic in the curricula.

Launched in November 2022, GenB is a 30-month project, funded by Horizon Europe, the European Union's funding programme for research and innovation.

Let's watch this video about the [GenB project](#).

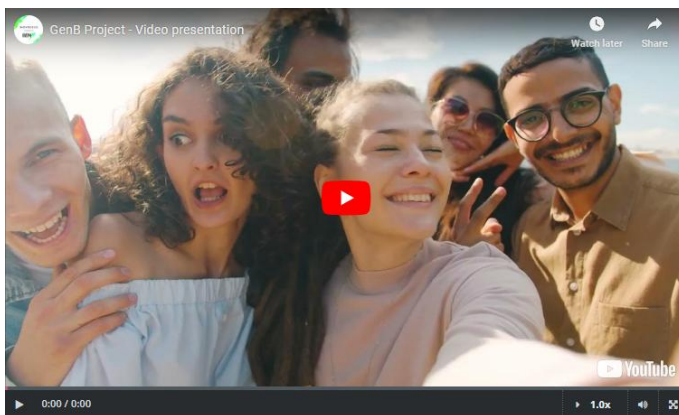


Figure 28. BIOVOICES (September 2023). GenB Project-Video Presentation [Video]. YouTube. Available at: <https://www.youtube.com/watch?v=qeHX-kaPlvM>



You want to know more? Browse through the [GenB Project website](#) to familiarise with its content and resources.

3.1.3. The GenB virtual library

Are you looking for an easy and effective way to teach bioeconomy without getting overwhelmed by too many resources?

The GenB Virtual Library has made it easier by gathering the all the tools and materials intended for teaching bioeconomy in one place. It helps provides resources to effectively explain these concepts to both students and the wider community.

GenB Virtual Library is a user-friendly, extensive repository of high-quality resources and tools sourced from previous EU initiatives, European Commission projects, and other reputable platforms. Perfect for young people, educators, parents, policymakers, and general public this library offers over 200 materials in several of the 24 official EU languages.

Navigate through **the presentation**, and discover how to unleash a wealth of valuable content to enrich your understanding and teaching of the bioeconomy, through the link: [2.1 How do we talk about bioeconomy in education? | Module 2: Bioeconomy in education: Best practices and challenges | Bioeconomy for Educators: Cultivating a Sustainable Future | European Schoolnet Academy](#)

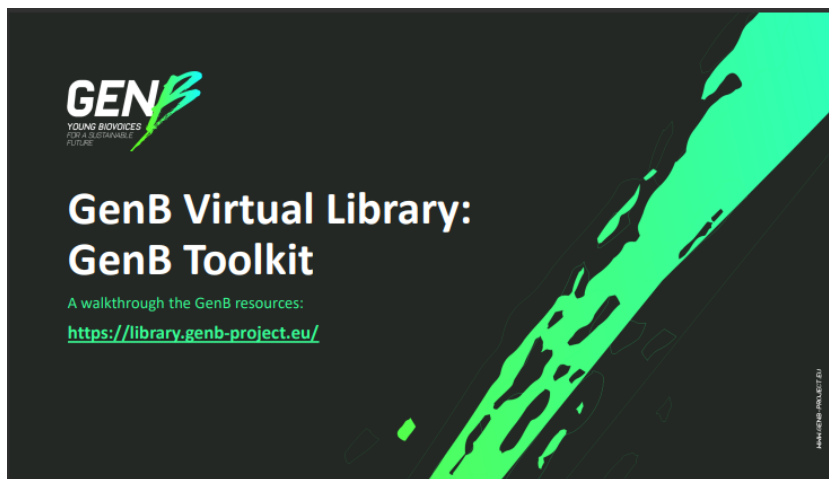


Figure 29. PowerPoint Presentation: GenB Virtual Library: GenB Toolkit, GenB Project

3.1.4. GenB Toolkits for students

GenB Toolkit is a rich **collection of diverse resources**, tools, and instructional materials designed to educate and raise awareness about bioeconomy. Tailored for a wide audience—including pre- and early-stage students (**4-8 years old**), elementary (**9-13 years old**) and high school (**14-19 years old**) students, **teachers**, and **multipliers**—these toolkits are available in **nine languages: Dutch, English, French, German, Greek, Italian, Portuguese, Slovenian, and Spanish**.



[GenB Toolkits for Students](#)

The student toolkit is intended for **student's independent search and discovery about bioeconomy**. It is made to provide a **comprehensive understanding** of the bioeconomy and **examples** how to become an agent and leader of change among peers and wider community. The toolkit contains games, experiments, factsheets and many more materials to learn and experience bioeconomy hands on. It also contains career factsheets and interviews with different experts in the field providing timely and relevant information highlighting various job opportunities within the bioeconomy sector, helping students envision potential career paths.

GenB toolkits for students target students of various age groups providing targeted materials for each group.

- [Toolkits for 4–8-year-old students](#)

- [Toolkits for 9–13-year-old students](#)
- [Toolkits for 14–18-year-old students](#)

The toolkits provide materials that allow students to gain a deeper understanding of bioeconomy principles, fostering critical thinking and practical skills through hands-on activities and real-world applications. By engaging with concepts like sustainability and the circular economy, learners develop essential competences for responsible decision-making and innovative problem-solving.

To help you understand and use the Toolkits faster, in the upcoming sections you will find more information about the included materials, pedagogical approaches and how to implement them in your lessons.

3.1.5. GenB Toolkits for teachers

The teacher toolkit is designed as a **compilation of teaching tools** and resources to allow you to **enhance their teaching practices** related to the bioeconomy. Based on GreenComps, the whole school approach, inquiry and project-based learning, as well as the 7-step Eco School Methodology, the toolkit contains a **wide variety of teaching materials for different age groups**.

The materials contain information such as:

- **Bioeconomy Overviews:** Detailed information, showcasing videos, gamified books, quizzes, card and escape games, as well as reports that explain the bioeconomy and its significance.
- **Educational Resources:** A variety of materials curated for both formal and non-formal education, including lesson plans, activities, and project ideas that can be integrated into existing practices or used for inspiration.

You can use the toolkits in multiple ways to enrich their educational practices:

- **Student Engagement:** Distribute the Student Toolkit or specific resources from the Teacher Toolkit directly to students, allowing them to independently explore the materials and gain insights into the bioeconomy and related career opportunities.
- **Resource utilisation:** Use the teacher toolkit in conjunction with the student toolkit to draw inspiration from the diverse resources available. This can aid in creating new lesson plans or enhancing existing ones with up-to-date and relevant content. This will hopefully provide students with a deeper understanding of the bioeconomy and its real-world applications.

The toolkits are designed to support a variety of pedagogical approaches to many of which you will be introduced to through this MOOC, making sure you can use them regardless of your teaching style and approach. Some indicative pedagogies are:

- **Inquiry-Based Learning and Project-based learning:** The resources in the toolkit encourage students to ask questions and explore the bioeconomy through research and investigation, making them suitable not only for research-based tasks but also for problem-solving approaches.
- **Experiential Learning:** The provided resources in the toolkits involve students with hands-on activities, helping them to connect theoretical knowledge with practical applications in the bioeconomy.

- **Differentiated Instruction:** The range of materials is suitable for different learning levels and styles, ensuring that students can access and benefit from the toolkits and teachers can adjust the materials depending on their goals, curricula and lesson plans.

These toolkits are an asset for both you and your students, as they provide the tools and knowledge necessary to understand and engage with the bioeconomy in meaningful and impactful ways.

3.2. Bioeconomy and the competences of the future

3.2.1. How do we talk about bioeconomy in education?

In the previous Unit, you explored the reasons why education is a vital component in bringing the society closer to a bioeconomy. You also highlighted not only the important roles teachers and educators play in this transition but also resources that can be used to support this work.

So now let's place the spotlight on each of you. Let's initiate a discussion about your practices and the ways you have chosen so far to bring the bioeconomy in your classrooms. The questions below can help you initiate this discussion. You can use the Tricider to record your reflections but make sure to respond to at least two other participants' experiences to facilitate deeper reflections and conclusions.



Guiding Questions:

- What aspects do you think are key when addressing such a complex topic in your classroom?
- What difficulties have you found while teaching related topics? Share possible solutions to these difficulties.

As a part of which subject or curricular unit could you talk about bioeconomy?

Share your opinion in the Tricider: [2.2. Bioeconomy and competences of the future | Module 2: Bioeconomy in education: Best practices and challenges | Bioeconomy for Educators: Cultivating a Sustainable Future | European Schoolnet Academy](#)

The screenshot shows a Tricider discussion interface with three columns: Ideas, Pro and cons, and Votes. The 'Ideas' column contains several entries related to bioeconomy in education, such as 'Bioeconomy in education is a very important field in the context of sustainability and environment...' and 'Bioeconomy education supports a transition toward a more sustainable, resilient, and low-carbon...'. The 'Pro and cons' column shows responses like 'I agree', 'I agree with you', and 'Great, I agree'. The 'Votes' column shows the number of votes for each idea, with a total of 73 votes displayed. A 'Vote' button is visible at the bottom right of the interface.

Figure 30. Tricider

3.2.2. Green Competences

To support the skills learners will need for the green and transition to the more sustainable lifestyles, the European Commission (EC) has developed the European Sustainability Competence Framework, called '**GreenComp**'. Developed by the Joint Research Centre of the European Commission, the framework **identifies a set of sustainability competences** that can be integrated into educational programs with the aim to help learners acquire knowledge, skills, and attitudes **that encourage empathetic, responsible, and caring thinking, planning, and action towards the planet and public health.**

"GreenComp is a reference framework for sustainability competences and provides a common ground to learners, as well as guidance to educators, advancing a consensual definition of what sustainability as a competence entails. It responds to the growing need for people to improve and develop the knowledge, skills, and attitudes to live, work and act in a sustainable manner. It is designed to support education and training programmes for lifelong learning. It is written for all learners, irrespective of their age and their education level and in any learning setting – formal, non-formal and informal. Sustainability competences can help learners become systemic and critical thinkers, as well as develop agency, and form a knowledge basis for everyone who cares about our planet's present and future state." (Bianchi & Cabera-Giraldez, 2022, pg.2)

Source: Bianchi, G., Pisiotis, U. and Cabrera Giraldez, M., *GreenComp. The European sustainability competence framework*, Punie, Y. and Bacigalupo, M. editor(s), EUR 30955 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-53201-9, doi:10.2760/821058, JRC128040

3.2.3. GreenComps and GenB materials

GreenComp framework is designed to serve as a **flexible reference for learning programs** and educators **fostering sustainability as a competence**, without being overly prescriptive. It aims to emphasise the need to help students develop new sets **of transversal skills** and competences for the future, that will help them become active citizens, work collaboratively with others, and communicate effectively.

GreenComp is a framework that outlines the key competences needed for sustainability. It includes **four main areas and 12 competences**, which are **interconnected** and aim to **develop sustainability skills** for everyone. Each competence comes with a descriptor explaining its main aspects.

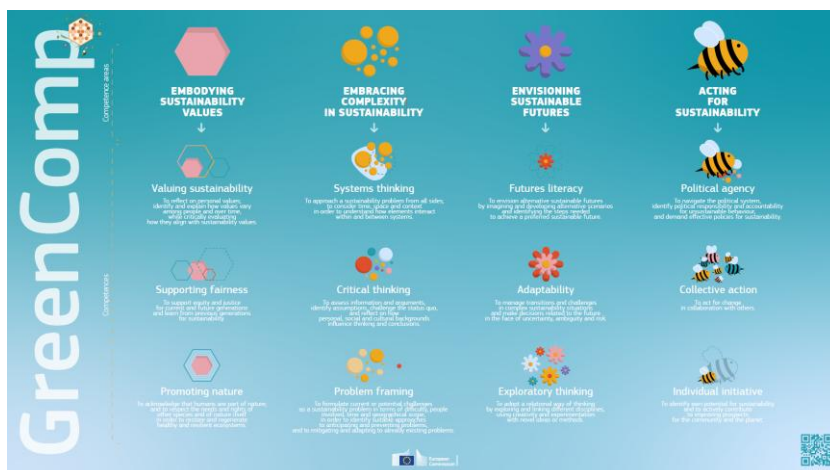


Figure 31. Source: The GreenComp Framework, European Commission, 2024.

The GenB materials are based on the **GreenComp Framework** and are aimed at developing key competences for transitioning to more sustainable lifestyles. For example, **Systems Thinking** can be developed through the [Escape4Future - Chemistry meets Circular Bioeconomy](#) escape room, where students solve interconnected challenges related to green chemistry and bioeconomy systems. **Sustainable Action** is fostered by the [Hands-on Labs: Bioeconomy Experiments](#), where students engage in transforming bio-waste into bio-based products, promoting responsible resource management. **Critical Thinking** is encouraged with the [GenB Bioeconomy Quiz](#) and [Educational Cards](#), allowing students to analyse and reflect on topics like bioenergy and waste management. Lastly, **Futures Thinking** is nurtured with the [Bioeconomy Job Profiles](#), introducing students to bioeconomy careers and helping them envision the long-term impact of sustainable actions, complemented by the [participatory photography activity](#) to visualize real-world applications.

For more information read the full [GreenComp](#) framework below:



Figure 32. Bianchi, G., Pisiotis, U. and Cabrera Giraldez, M., GreenComp. The European sustainability competence framework, Punie, Y. and Bacigalupo, M. editor(s), EUR 30955 EN, Publications Office of the European Union,

Luxembourg, 2022, ISBN 978-92-76-53201-9, doi:10.2760/821058, JRC128040,
<https://publications.jrc.ec.europa.eu/repository/handle/JRC128040>

3.2.4. GreenComps in the classroom – Activity

Reflect on the [GreenComp](#) competences associated with teaching bioeconomy.

- Which of these competences do you think is the most complex?
- How do you believe they are connected to teaching bioeconomy concepts?

Share your thoughts in the [Padlet](#) on how you would work on developing these competences in your classroom, including specific strategies or GenB materials you might use.

Engage with your peers by commenting on their posts and offering insights or suggestions!

Access the Padlet through the link: <https://padlet.com/eunacademy/greencomps-in-the-classroom-activity-ugzl8srhgw5plsb2>

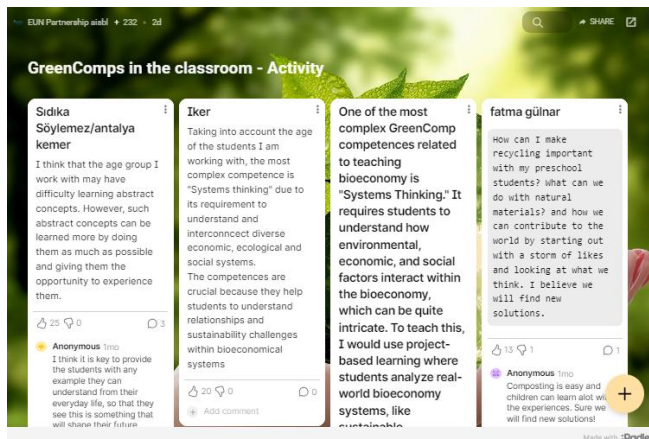


Figure 33. Padlet: <https://padlet.com/eunacademy/greencomps-in-the-classroom-activity-ugzl8srhgw5plsb2>

3.2.5. GreenComps in the classroom

Connect the four main areas of GreenComps with their respective competences. The final deadline to complete all activities is **Wednesday, 20 November, 23:59 CET**. The participation in this activity will amount to 5% of the final grade. Find the drag and drop activity on the link: [2.2. Bioeconomy and competences of the future | Module 2: Bioeconomy in education: Best practices and challenges | Bioeconomy for Educators: Cultivating a Sustainable Future | European Schoolnet Academy](#)

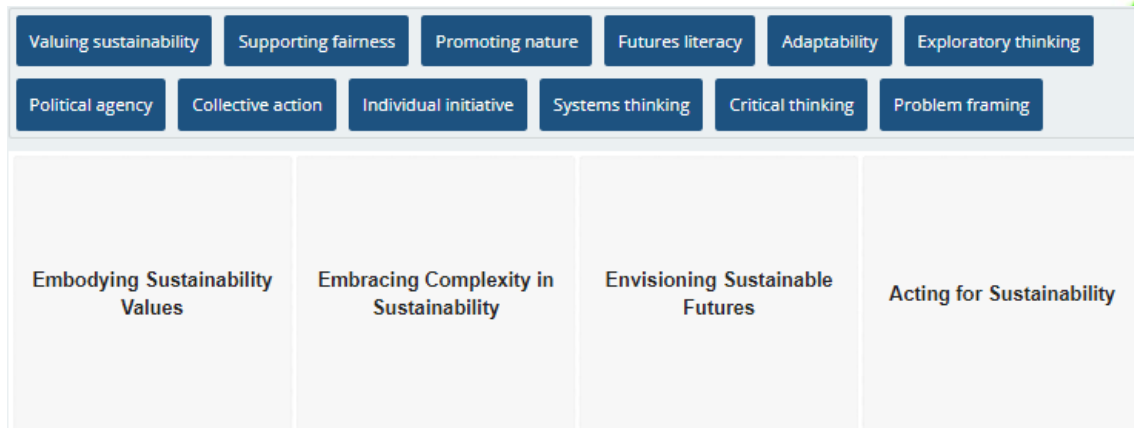


Figure 34. Drag and drop activity

Drag and drop activity answer key and feedback:

Areas	Competences
Embodying Sustainability Values: Focusing on personal values, fairness, and respect for nature.	Valuing sustainability: Reflect on and align personal values with sustainability
	Supporting fairness: Promote equity and justice for current and future generations.
	Promoting nature: Recognize the importance of ecosystems and the rights of other species.
Embracing Complexity in Sustainability: Understanding sustainability through different lenses.	Systems thinking: Approach problems by considering all interconnected elements.
	Critical thinking: Evaluate information, challenge assumptions, and reflect on influences.
	Problem framing: Define challenges in terms of scope, time, and geography to find solutions.
Envisioning Sustainable Futures: Focusing on imagining and planning for sustainable futures.	Futures literacy: Envision alternative sustainable futures and identify the steps to achieve them.
	Adaptability: Manage transitions, make decisions in uncertain situations, and handle challenges related to sustainability.
	Exploratory thinking: Link different disciplines creatively and experiment with new ideas or methods.
Acting for Sustainability: Taking action towards achieving sustainability.	Political agency: Understand political systems and demand accountability and policies for sustainability.
	Collective action: Work together with others to drive change.

Areas	Competences
	Individual initiative: Recognize personal potential to contribute to sustainability and actively improve conditions for the community and the planet.

3.2.6. 21st Century skills and trends in the classroom

The Framework for 21st Century Learning, developed by Battelle for Kids, represents a comprehensive approach to preparing students for success in an increasingly complex, technology-driven, and interconnected world. There is an increased recognition that traditional educational paradigms are becoming insufficient to meet the demands of the 21st century, so this framework underlines the importance of a holistic, integrative approach to education and aims to equip students with the knowledge, skills, and competence necessary to navigate and thrive in a rapidly evolving global landscape.

The framework describes **4 key elements** and the specific competences they focus on:

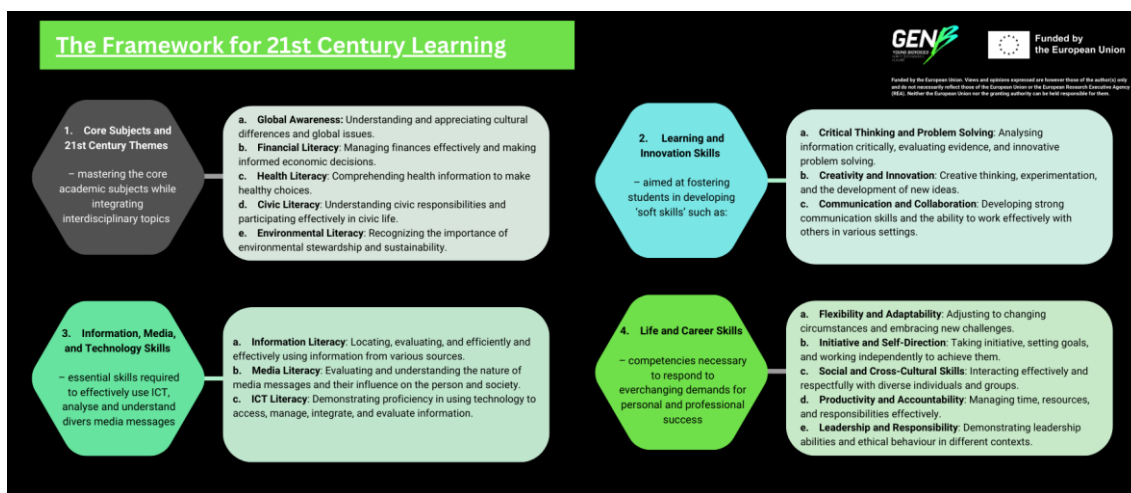


Figure 35. European Schoolnet based on Battelle for Kids. (2019). Framework for 21st century learning. http://static.battelleforkids.org/documents/p21/P21_Framework_Brief.pdf

To successfully implement these elements, the framework advocates for robust support systems that align educational practices with 21st-century skills:

1. **21st Century Standards:** Focus is on establishing rigorous standards that incorporate 21st-century skills across all academic disciplines.
2. **Assessment and Accountability:** Entails utilization of assessment methods that accurately measure student proficiency in 21st-century skills.
3. **Curriculum and Instruction:** Emphasises the design of curricula and instructional practices that integrate 21st-century themes and skills.
4. **Professional Development:** aims at providing educators with ongoing professional development opportunities to enhance their ability to teach 21st-century skills.
5. **Learning Environments:** Creating dynamic learning environments that foster collaboration, innovation, and critical thinking.

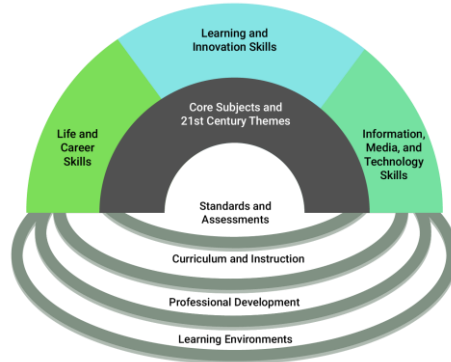


Figure 36. European Schoolnet, adapted from Charles Fadel and Krishna Chaitanya Velaga - File:Framework for 21st Century Learning.jpg, CC BY-SA 4.0, <https://commons.wikimedia.org/w/index.php?curid=77435748>

Check out this short video to learn how critical thinking, communication, collaboration, and creativity are essential 21st-century skills for today's students.



Figure 37. Common Sense Education. (2016, July 12). What are the 4Cs? [Video]. YouTube. <https://youtu.be/QR EEVZa3f98?si=6JLBEFu5sViTMpHI>

For More information and additional guides visit the [BattelleforKids website](#).

Source: Battelle for Kids. (2019). Framework for 21st century learning. http://static.battelleforkids.org/documents/p21/P21_Framework_Brief.pdf

3.3. Bioeconomy and integrated STEM teaching

3.3.1. Bioeconomy in interdisciplinary classes

Most processes, ideas and things in the world cannot be explained through a singular approach. For example, many natural systems - such as the Earth's climate – cannot be fully understood and investigated without an interdisciplinary approach, since there are so many subsystems that contribute to it, like the oceans, the atmosphere, solar radiation, land cover, carbon dioxide emission, etc.

An **interdisciplinary approach** relates to more than one category of knowledge. It refers to teaching across multiple subjects, by incorporating knowledge and skills them to enrich the overall educational experience.

Interdisciplinary education allows students to learn by **making connections** between **ideas and concepts across different disciplines** and better **understand the connection between their studies and the real world**. It can **boost confidence** in subjects often seen as challenging, as they are taught in an integrated manner, focusing on and **employing diverse skills** of students. Interdisciplinary classes also **enhance students' collaboration skills** and provide significant **professional development opportunities** for teachers and staff. Moreover, it encourages students to learn in an **engaging and enjoyable** way.

3.3.2. Bioeconomy in interdisciplinary classes -Example

Here's a good example!

The “**Growing plastic & new life for plastic**” learning scenario is aimed at **students aged 11-18** and it **combines Biology, Technology, Engineering, Environmental Education, Chemistry and Statistics** as its topics. The scenario tackles the issue of **plastic pollution** and aims to familiarize students with **bioplastics**. Students investigate bioplastics and their properties in the lab and acquire practical knowledge by creating plastic from potato starch and other foods. Then, students investigate the effect of plasticiser on the properties of the polymer they made. Finally, the class creates a **3D model**, using a 3D printer.



Cossu, C., Deckx, N., Hermans, S., & Mura, C. (n.d.). *Growing plastic & new life for plastic* [Learning Scenario]. BLOOM School Box - Bloom-Bioeconomy. <https://bloom-bioeconomy.eu/repository/ls5/>

Watch this short [video](#) below, in which the expert teachers share their experiences of implementing this learning scenario:



Figure 38. European Schoolnet Academy. (2019, November 29). Bloom School Box – Growing plastic and new life for plastic [Video]. YouTube. Available at: https://youtu.be/IGT--khBj_w

3.3.3. Bioeconomy in STEM Subjects

Physics may not be the first subject that comes to mind when thinking about bioeconomy. However, the **connection between physics and bioeconomy is essential**, especially when teaching about energy saving, architecture, combustion (heat and gas), fossil fuels and their alternatives. In this section, you will discover one of the BLOOM Learning Scenarios that aims to involve students in examining the thermal properties of biobased building materials.



Fertala, N., Kawecka, E., Glaz, L. S., & Weikmann, B. (n.d.). *Examining the thermal properties of bio-based building materials* [Future Classroom Scenario]. BLOOM School Box - Bloom-Bioeconomy. <https://bloom-bioeconomy.eu/repository/ls2/>

The **“Examining the thermal properties of bio-based building materials”** aims to **connect bioeconomy to temperature and heat flow**. It is divided into three lessons employing various teaching methods. The first lesson, **Knowledge Café**, aims to encourage students to provide a definition on bioeconomy, while the second one, **Experimental Laboratory**, focuses on introducing students to thermal insulation. Students undertake experiments to investigate the thermal insulation of biobased and non-biobased building materials. The final lesson, **Mathematical Analysis in PC-Lab** aims to teach students how to conduct empirical analysis using suitable mathematical techniques. Apart from a Physics class, the Learning Scenario can be implemented in Mathematics, Chemistry or Biology classes as well. The Learning Scenario is developed for **students aged 16-19**.

By the end of the lessons, students should have a practical knowledge of temperature and the flow of heat from areas of high temperature to areas of low temperature. They should be able to connect the modelled and real heat flow while using biobased building material.

Watch the [video](#) below to find out more about what the teachers who developed this Learning Scenario experienced:

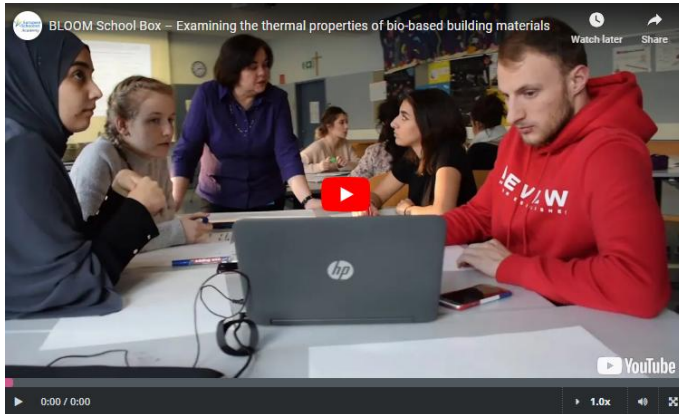


Figure 39. European Schoolnet Academy. (2019, November 29). BLOOM School Box – Examining the thermal properties of bio-based building materials [Video]. YouTube. <https://youtu.be/AUHatgNjO58>

3.3.4. Bioeconomy in interdisciplinary classes -Example

Interdisciplinary teaching brings together different areas of knowledge to enrich learning and reflect the complexity of real-world issues. Think about a time when you used an interdisciplinary approach in your teaching. Reflect on how you combined different subjects to approach a topic in an integrated way:

- How did your students engage with the interdisciplinary approach?
- What successes and challenges did you encounter while implementing it?
- How do you think integrating multiple subjects enhanced your students' understanding of the topic?

Share your experience on the [discussion platform](#) and engage with your peers by offering feedback and suggestions on their posts. Access the Padlet through the link: <https://padlet.com/eunacademy/interdisciplinary-teaching-dus5i2n2cr46uq4l>

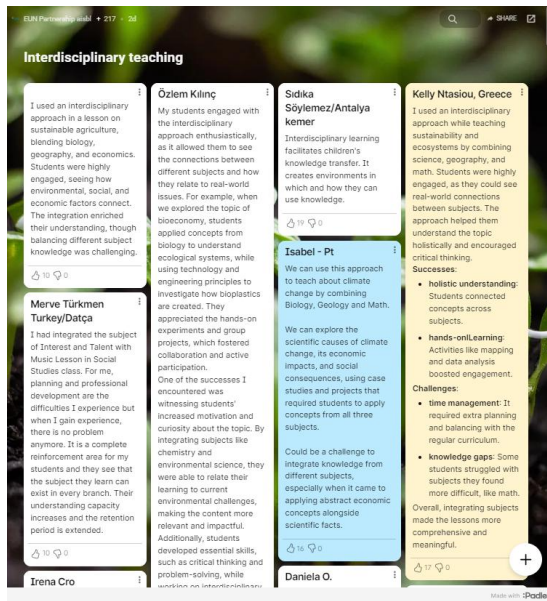


Figure 40. Padlet: <https://padlet.com/eunacademy/interdisciplinary-teaching-dus5i2n2cr46uq4/>

3.4. Bioeconomy with students from 4-8 years old

3.4.1. Introduction

Introducing bioeconomy concepts **as early as possible**, is crucial for nurturing environmentally conscious future generations. Young children are **naturally curious**, and **using simple stories, fun activities, and games can make these ideas easier for them to grasp**. By learning about things like renewable resources and recycling, children can start to see how their actions affect the planet and learn how to make better choices.

GenB project developed a toolkit with various materials to help teachers introduce the topic in their lessons. You can explore the materials on the link: <https://genb-project.eu/toolkits/?category=4-8-years-old>

In the next section, we'll cover three key ideas for teaching bioeconomy to young children: **storytelling, hands-on activities, and a gamified approach**. These methods will help make learning about bioeconomy engaging and meaningful for your students.

3.4.2. Storytelling method

Storytelling is a powerful tool for teaching about bioeconomy as it captures students' **imagination** and helps them understand complex ideas in a **simple and engaging way**. Stories can show the importance of preserving resources and how everyone, even kids, can play a role in protecting the environment.

To make storytelling even more impactful, you can create **interactive stories** where children make decisions about what happens next. This approach gives them a **sense of control and involvement**, making them feel like they are **active participants** in the story. By making them the protagonists, you can help them understand their role in the bioeconomy and inspire them to think about **how they can contribute to a sustainable future**.

In your stories, you can **use familiar objects** like apples, algae, or manure to connect the concepts to their everyday experiences. Keep the stories **positive and hopeful**, showing that even small actions can make a big difference. This interactive storytelling approach not only makes learning fun but also empowers children to see themselves as key players in creating a better world.

[GenB Toolkit for students from 4-8 years old](#), includes several materials based on this principle. One of the materials is **book for kids "What's bioeconomy?"** that introduces the **concepts of sustainable and circular bioeconomy** with a focus on bio-based products, explained in an easy-to-understand way. The book is **interactive** and available **in 12 languages**.

Take a look at the [video](#) below, where you can hear students talk about the book from their perspective.



Figure 41. BIOVOICES project. (March 2021). What's bioeconomy? Book for kids [Video]. YouTube. https://www.youtube.com/watch?v=Jnt9nLEu3mM&ab_channel=BIOVOICESProject

In addition, a **“The Apple’s dream” fairy tale** was developed within the project. The story explores key bioeconomy concepts such as the reuse and transformation of residues into valuable resources, helping to reduce waste and preserve our planet, through an engaging story and a series of images.

3.4.3. Hands-On Activities

At this stage, learning by doing helps children understand complex ideas in a fun and interactive manner. Hands-on experiments, where students actively explore and discover, make the concept of bioeconomy more relatable and memorable. By adapting the **STEAM approach**, you can design **simple experiments** and projects that connect bioeconomy topics to everyday life. Consider creating workshops that combine these activities into a larger, **contextualised sustainability project**, or redesigning **classroom and playground spaces** to make them more engaging and eco-friendlier.

The GenB project has developed a series of **hands-on experiments**, tested with young students, showing how bio-waste can be transformed into useful products. These activities make the concept of bioeconomy both accessible and exciting for young students:



Figure 42. Hands-on experiment: Watercolours from fruits and vegetables! [Factsheet]. https://genb-project.eu/app/uploads/2024/09/UseFruits_Brochure_genB_JJ_20240327-1.pdf

Explore all the hands-on experiments through the links below:

- [Hands-on experiment: Watercolours from fruits and vegetables!](#)
- [Hands-on experiment: bio-based plastics from corn starch!](#)
- [Hands-on experiment: Make home-made natural toothpaste!](#)

3.4.4. Gamified approach

We all know that playing isn't just for kids—it's a fundamental way of learning for everyone! When it comes to teaching bioeconomy, gamification can turn learning into an adventure.

Gamified approach uses **game mechanics** like points, leaderboards, and achievements to make learning more **engaging** and **motivating** for students. It fosters **active participation** and **enhances retention** by turning educational activities into fun, rewarding experiences.

One option is to use **educational games** that focus on bioeconomy themes, such as sorting waste into the correct recycling bins or designing eco-friendly solutions. Check out this example: [Eco Cycle Recycle Game](#). This is a simple game that even young students can create during their programming or coding lessons!

Interactive challenges can also boost learning by having students work in teams to solve bioeconomy problems, like creating a sustainable city with bio-based materials. Adding a **reward system**, like stickers or badges, can keep kids motivated and celebrate their achievements.

Additionally, **combining storytelling** with interactive elements lets students guide a character through recycling and sustainability decisions, making the learning process even more immersive and enjoyable.

As an example, check this [card game](#), developed by the GenB project, and designed to introduce children aged 4 to bioeconomy-related professions.



Figure 43. GenB Project. (2024). BioHeroes: Let's Save the Planet! [Card game]. https://genb-project.eu/genb_toolkit/bioheroes/

You can find more games and game-based activities in the [GenB Library](#).

3.4.5. Reflection Activity

Introducing bioeconomy concepts to young students is essential in fostering environmentally conscious future generations. Reflect on your experiences or ideas for incorporating bioeconomy with young learners. Have you used methods like storytelling, hands-on activities, or games to teach sustainability? Consider these questions:

- Have you ever used storytelling techniques to explain complex concepts such as bioeconomy, and how did students connect with them? What topics have you explored this way?
- How do hands-on activities help young students understand sustainability and bioeconomy? Can you share a specific example?
- How might gamification be used to teach bioeconomy in an engaging way? What potential does it have for increasing student participation and motivation?

Share your opinions on the Padlet: <https://padlet.com/eunacademy/introducing-bioeconomy-concepts-to-young-students-i9t6d3hlcqovqdrm>

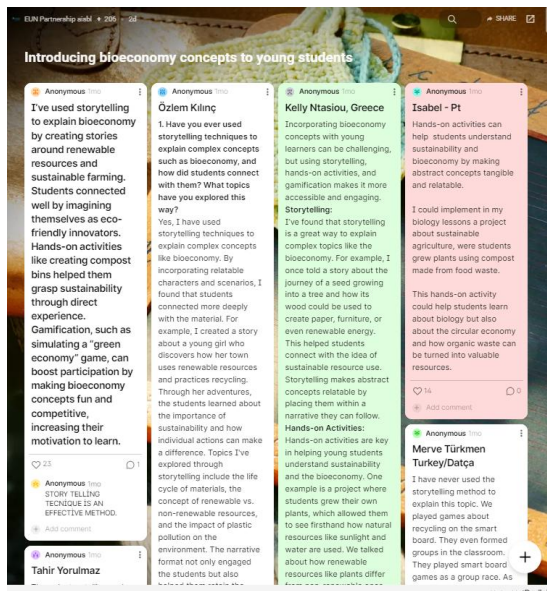


Figure 44. Padlet: <https://padlet.com/eunacademy/introducing-bioeconomy-concepts-to-young-students-i9t6d3hlcqovqdrm>

3.5. Bioeconomy with students from 9-13 years old

3.5.1. Introduction

As students' brains develop, they become better at understanding complex topics and connecting them with other areas of learning. Since the interdisciplinary approach more commonly used in elementary schools, with students from the ages 9 to 13, teaching bioeconomy through various subjects' benefits both students and teachers. Even the developing ethics at these ages can begin to raise awareness about the issue of sustainability in a more personal way. Connecting bioeconomy to real-life scenarios and practical activities makes learning more engaging and relevant, potentially increasing students' interest in STEM careers.

GenB project developed a [toolkit for students from 9 to 13 years old](#) with various materials to help teachers introduce the topic in their lessons. We will explore the different materials within in the following sections.

In the upcoming units you reflect upon how to talk about bioeconomy with elementary school students by using the interdisciplinary approach. In addition, you will learn about the inquiry-based approach and living labs and explore various materials that can help you engage your students in exploring bioeconomy.

3.5.2. Interdisciplinary approach

Studies have reported that early childhood education matters greatly when it comes to students enjoying STEM and later choosing STEM careers. This interest can be fuelled by **practical exercises**, as well as showing **confidence and enthusiasm** when teaching science. In addition, to bring topics in the classroom that are **connected to real life**, such as the topic of bioeconomy.

Bioeconomy can be easily integrated into elementary school classrooms through the previously mentioned interdisciplinary approach. **Connecting bioeconomy to real-life scenarios and practical activities makes learning more engaging and relevant.** As students' brains develop, they become better at understanding complex topics and connecting them with other areas of learning.



Kunac, I., Abril, M. A., Valencia, M., & Milić, A. (n.d.). *How poop will change the world* [Future Classroom Scenario]. BLOOM School Box - Bloom-Bioeconomy. Retrieved from <https://bloom-bioeconomy.eu/wp-content/uploads/2019/02/BLOOM-LS-TEAM4-How-to-change-online.pdf>

This Learning Scenario aims to engage younger students in the topic of **energy and ways we can produce it**. The lesson starts with a discussion about energy and its production in the future (including human waste and animal waste). In the second part of the lesson, students listen to a lecture about bioeconomy after which they engage in an exercise: the **creation of a brochure about fossil fuels, biomass and renewable energy sources**. Then, they **present their findings** and their brochures. Finally, there is a **quiz** about energy and bioeconomy. While the “How poop will change the world” scenario is created for students aged 13-15, it can be

implemented for younger students as well (10-12 years old). You can find information for the adaptation in the Learning Scenario itself.

Watch the [video](#) below to find out more about the implementation of this Learning Scenario:



Figure 45. European Schoolnet Academy. (n.d.). BLOOM School Box – How poop will change the world [Video]. YouTube. <https://youtu.be/6xucTUujs1Q?si=xGVH3V8Yo7wMMc6c>

References:

- European Commission, Directorate-General for Education, Youth, Sport and Culture, Evagorou, M., Puig, B., Bayram, D. (2024). *Addressing the gender gap in STEM education across educational levels: analytical report*, Publications Office of the European Union. <https://data.europa.eu/doi/10.2766/260477>
- ESDE (2023). *Employment and Social Development in Europe 2023*. DG - Employment Social Affairs & Inclusion. <https://op.europa.eu/webpub/empl/esde-2023/esde-review.html>

3.5.3. Inquiry in the classroom with bioeconomy

Many teachers face obstacles when aiming to teach their students the method of scientific research. Many students feel that science or learning science is only for people with a further academic interest. **Inquiry-based learning (IBL)** is an excellent remedy to this, as it aims to teach students the scientific method while letting them be agents of their own learning. First, let us learn about IBL and then let's move on to explore through one Learning Scenario how bioeconomy can be used to start implementing inquiry in your classroom.

Inquiry-based learning (IBL) is an educational strategy through which **students follow methods and practices similar to those of professional scientists in order to construct knowledge** (Keselman, 2015). One of the benefits of using IBL is that the students are an **active part** of their own learning process: they must suggest an experimental activity to peers and design it. IBL is organised into different steps, in which **you guide students** to think about an experimental idea, design the experiment and present the results to their peers.

Explore different levels of inquiry-based learning, defined by Bianchi and Bell (2008) by checking the [Genially board](#):

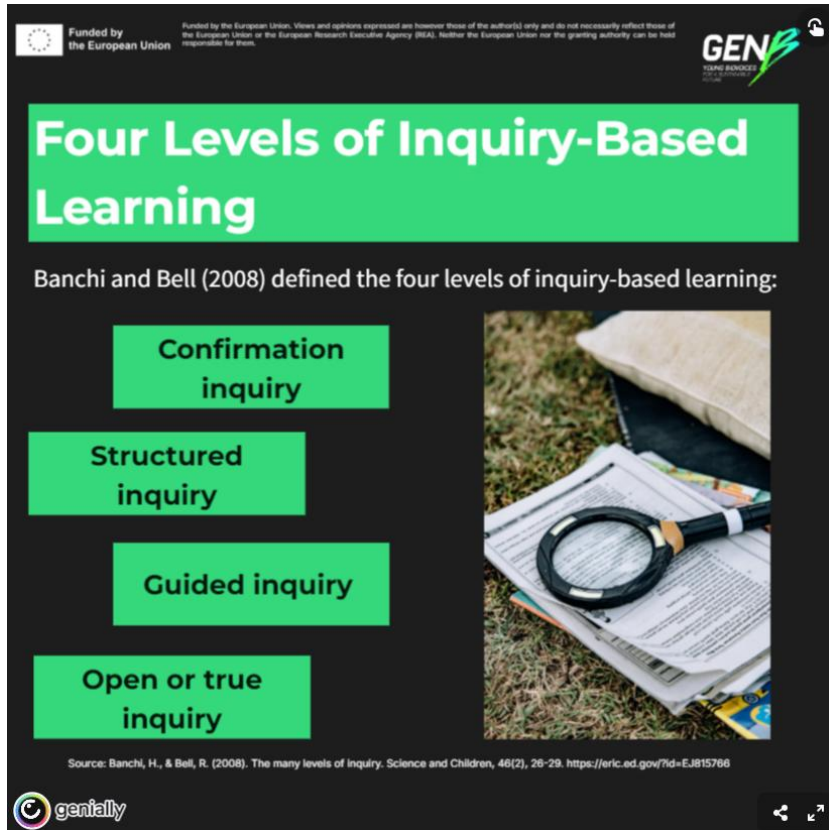


Figure 46. Four Levels of Inquiry-Based Learning, GenB Project, <https://view.genially.com/670443de3886c5ef7704971e/interactive-content-inquiry-based-learning>

There are several phases involved in an inquiry-based lesson or project, as [Pedaste et al \(2015\)](#) observed:

- **Phase 1: Orientation.** This can take the form of a class discussion, where students become aware of the main idea at hand.
- **Phase 2: Conceptualisation.** This phase involves student asking questions and formulating hypotheses.
- **Phase 3: Investigation.** This is where students explore, experiment and interpret data. This can happen in a cyclical fashion. First, they collect data, then they analyse it, after which they may go back to exploring, based on findings. They continue this until they enter the next phase.
- **Phase 4: Conclusion.**

References

- Pedaste, M., Mäeots, M., Siiman, L. A., de Jong, T., van Riesen, S. A. N., Kamp, E. T., Manoli, C. C., Zacharia, Z. C., & Tsourlidaki, E. (2015). Phases of inquiry-based learning: Definitions and the inquiry cycle. *Educational Research Review*, 14, 47-61. <https://doi.org/10.1016/j.edurev.2015.02.003>

- Banchi, H., & Bell, R. (2008). The many levels of inquiry. *Science and Children*, 46(2), 26-29. <https://eric.ed.gov/?id=EJ815766>

Keselman, A. (2003). Supporting inquiry learning by promoting normative understanding of multivariable causality. *Journal of Research in Science Teaching*.
<https://doi.org/10.1002/tea.10115>

3.5.4. Inquiry in the classroom with bioeconomy – Example

You can also see how to implement the steps of inquiry-based learning in the [Learning Scenario “Building a new environmental future”](#). The Learning Scenario involves Biology, Chemistry, Biochemistry, Geology and Natural Science as its subjects. It is also adaptable for both younger (13 -15 years old) and older students (15 -17 years old). The scenario is divided into three parts. The first part introduces bioeconomy. After watching a short clip about bioeconomy, students receive different objects that they have to categorize according to them being biobased or non-biobased. This involves the **orientation and conceptualization phases** of the inquiry lesson. The second part involves finding ways to use different energy sources with minimal waste. For older students, this part can also include a visit to a local industry. This is the **investigation phase** of the inquiry lesson. The third part for younger students involves planning an exhibition or science fair; for older students: planning a science project, together with local stakeholders. This is the **conclusion phase** of the inquiry learning process.



Azevedo, M., Fradique, J., Magid Podolsky, S. & Pelehov, V. (n.d.). *Building a new environmental future* [Future Classroom Scenario]. BLOOM School Box - Bloom-Bioeconomy. Retrieved from <https://bloom-bioeconomy.eu/repository/ls3/>

Watch the video below for more details on the implementation of this Learning Scenario:



Figure 47. Embed video: European Schoolnet Academy. (2019, November 29). BLOOM School Box - Building a new environmental future [Video]. YouTube. <https://youtu.be/UtwKfUgzWdY>

3.5.5. Living Labs

Living Labs are concept that emerged in the early 1990s (e.g., Bajgier et al., 1991) and have transformed the landscape of research and development. While there is no universally accepted definition for Living Labs, Professor William Mitchell, who is most prominently associated with the concept, defines them as *"a research methodology for sensing, prototyping, validating, and refining complex solutions in multiple and evolving real-life contexts."*

Living Labs distinguish themselves from traditional labs by emphasizing **user-centricity, experiential learning, real-life context, and the co-production of knowledge through co-creation methodologies.**

Living Labs typically involve heterogeneous actors, usually described as a **4P partnership: 'public-private-people-partnerships'** (Leminen, 2012). The **GenB Living Labs** aimed to **co-create innovative approaches**, formats, materials, and tools through collaboration among children, young adults, parents, teachers, and other education professionals. Their goal was to provide educational and informational toolkits on bioeconomy and bio-based sectors.

Living Labs operate through a structured process with four main stages, which can be iterative depending on the context. The stages, as adapted by the GenB Living Labs from Westerlund and Leminen (2012) and featured in the Inmédiats Handbook (Millet et al., 2014), are:

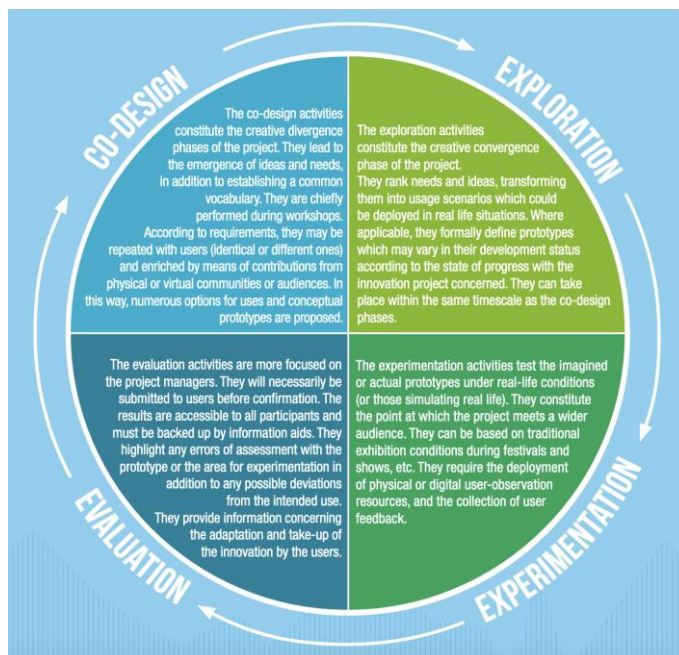


Figure 48. Adaptation of the "Key Activities" diagram from "Ou est-ce qu'un living lab? – Coll, umveit – Montreal in vivo – March 2014 – p.122. https://www.slideshare.net/Malvina_Artheau/inmediats-livinglab-handbook

Do you want to discover how other schools implemented their activities in the Living Lab format? Check these examples:

- [Overview of Living Labs organised in Austria](#)
- [Overview of Living Labs organised in Italy Part 1](#)

- [Overview of Living Labs organised in Italy Part 2](#)
- [Overview of Living Labs organised in Greece](#)

On the links below, you can find several interactive activities that can be implemented as a part of a Living Lab, each of the materials contains detailed guidelines on how to implement them:

- GenB Project. (2024). *Escape4Future - Chemistry meets Circular Bioeconomy* [Educational game]. https://genb-project.eu/genb_toolkit/escape4future/
- GenB Project. (2024). *Hands-on Labs: Bioeconomy Experiments*. https://genb-project.eu/genb_toolkit/hands-on-labs-bioeconomy-experiments-2/
- GenB Project. (2024). *Super-bio: Learning Bioeconomy through play* [Educational board game]. https://genb-project.eu/genb_toolkit/biorace/
- Transition2Bio. (n.d.). *Experiments at home and at school* [Game/Teaching materials]. <https://library.genb-project.eu/VLToolkit?id=a030900000TSPk8AAH>

References:

- Bajgier, S. M., Maragah, H. D., Saccucci, M. S., Verzilli, A., & Prybutok, V. R. (1991). Introducing students to community operations research by using a city neighborhood as a living laboratory. *Operations Research*, 39(5), 701–709. <https://doi.org/10.1287/opre.39.5.701>
- Leminen, S., Westerlund, M., & Nyström, A.-G. (2012). Living Labs as open innovation networks. *Technology Innovation Management Review*, 2(9), 6–11. <https://timreview.ca/article/602>
- Millet, F., Artheau, M., Fuentes, R., Battais, L., Maggionni, L., Laval, D., Dosseur, B., & Amouroux, T. (2015). *Inmédiats LivingLab Handbook*. [PDF file].

3.5.6. Reflection Activity

As students grow, their ability to grasp complex subjects like bioeconomy increases, especially through an interdisciplinary approach. Reflect on how you've integrated bioeconomy or sustainability topics into your lessons with students aged 9-13. How do you connect these topics to real-life scenarios and practical activities in your classroom? Share your experiences, challenges, or ideas with your peers.

- How have you applied the interdisciplinary approach in teaching bioeconomy or other STEM topics? What subjects did you combine, and how did students react?
- Have you used inquiry-based learning (IBL) in your teaching? What impact did this have on their engagement?
- How can practical activities, such as living labs or hands-on experiments, make bioeconomy more relatable to students? Have you implemented any similar projects in your classroom?

Share your thoughts on [Padlet](#) and engage with your colleagues by commenting on at least two other posts. Access the Padlet here: <https://padlet.com/eunacademy/how-have-you-integrated-bioeconomy-or-sustainability-topics--2994gpwtgw2nw24n>



Figure 49. Padlet: <https://padlet.com/eunacademy/how-have-you-integrated-bioeconomy-or-sustainability-topics--2994qpxtwg2nw24n>

3.6. Bioeconomy with students from 14 – 18 years old

3.6.1. Introduction

As students transition into their teenage years, their understanding of the world becomes deeper and more nuanced. The move to secondary education implies **approaching knowledge from more specific subjects** which makes interdisciplinary teaching more challenging. Vocational/occupational guidance takes on more prominence here too.

In addition, teachers have the challenge to call and maintain students' attention through different methods, such as social media, more challenging games, cognitive conflicts...

Teaching bioeconomy in secondary schools can be particularly impactful when approached through various strategies:

- **Real-World Connections:** Linking lessons to real-world bioeconomy applications helps students see the relevance of their studies. Examining current case studies and industry practices makes the subject more tangible and applicable to their daily lives.
- **Project-Based Learning:** Long-term projects related to bioeconomy enable students to apply theoretical knowledge to practical problems. We will expand on this theme in the next unit.
- **Interdisciplinary Integration:** Even though subjects are more specific, bioeconomy intersects with multiple subjects providing a holistic view of the field.
- **Career Exploration:** Introducing students to various career paths within the bioeconomy sector helps them explore potential future roles. Learning about different professions in research, industry, and policymaking can guide their career aspirations and skill development. We will explore this further in the next Module 3.
- **Hands-On Labs and Experiments:** Conducting practical experiments reinforces theoretical knowledge and engagement. These activities offer students firsthand experience with renewable resources and sustainable practices, bridging the gap between theory and practice. Furthermore, at these ages we can dare to go deeper into the chemical, industrial or economical processes behind bioeconomy.

When thinking about activities to implement with your students that could foster engagement, teamwork and making real-life connections, consider some of the following GenB materials:

- GenB Project. (2024). *Escape4Future - Chemistry meets Circular Bioeconomy* [Educational game]. https://genb-project.eu/genb_toolkit/escape4future/
- GenB Project. (2024). *Hands-on Labs: Bioeconomy Experiments*. https://genb-project.eu/genb_toolkit/hands-on-labs-bioeconomy-experiments-2/
- GenB Project. (2024). *Super-bio: Learning Bioeconomy through play* [Educational board game]. https://genb-project.eu/genb_toolkit/biorace/

3.6.2. Bioeconomy and project-based learning

Project-based learning (PBL) is an excellent method to **encourage students to take ownership of their learning process**. It is suitable when implementing new topics, such as bioeconomy, as it allows students to immerse themselves in the topic and develop their research skills.

Project-based learning (PBL) involves **learning through projects**, which entails shifting the focus from traditional education, where students are passive receivers of information, and the teacher is the (only) source of knowledge.

PBL involves **learner-centred decision-making**: students are able to plan their own project, instead of following a set of instructions. PBL can and should be **based on student inquiry**. It should include **peer and self-assessment**, rather than only relying on teacher assessment. Finally, the ownership of the project belongs to the **student**, as opposed to the **teacher**, whose role in this case is that of a **moderator**.

The Buck Institute for Education identifies the following seven steps of PBL:

1. **Challenging problem or question.** The project starts with something that is considered truly engaging for students.
2. **Sustained inquiry.** Students are continuously involved in asking questions, finding answers and researching.
3. **Authenticity.** It's advisable to choose a topic that students feel close to, but also to take their chosen project seriously. For example, having an exhibition for the school's community at the end of the project, as something to work towards.
4. **Student voice and choice.** Students need to be able to guide their own project.
5. **Reflection.** Apart from the final assessment, it is advisable to have reflection activities along the way.
6. **Critique and revision.** Students have to receive and give peer critique and revise constantly.
7. **Public product.** At the end of the project, students should have an end-product they can exhibit.

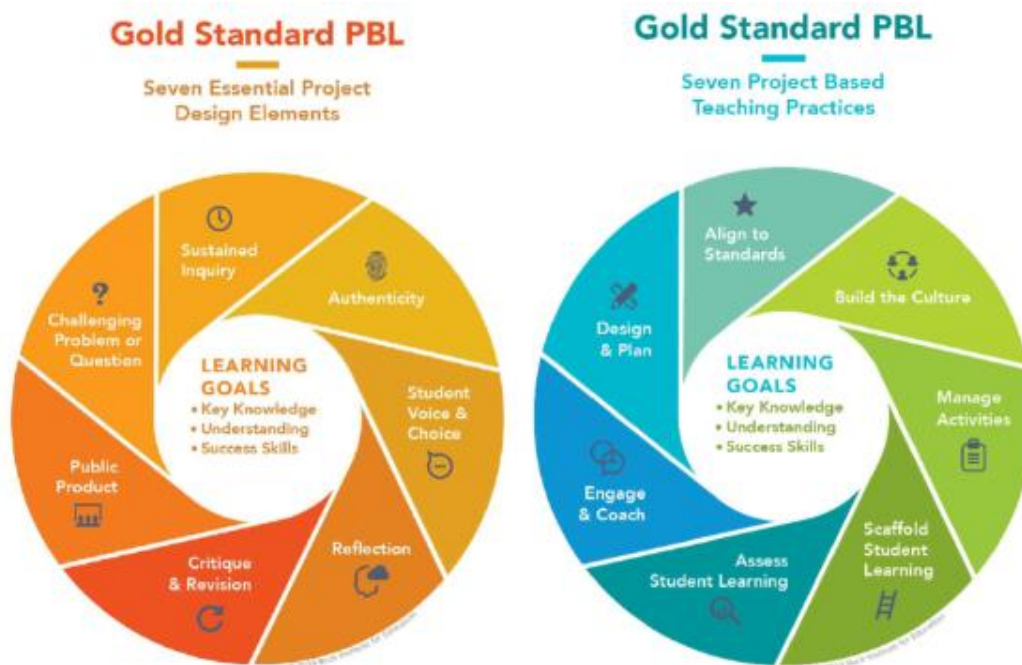


Figure 50. Gold Standard Project Based Learning by [PBLWorks](#) is licensed under [CC BY-NC-ND 4.0](#)

3.6.3. Bioeconomy and project-based learning – Example

The Learning Scenario “**Bloom your school with your biofuel and a soap lab**” was developed for **13–16-year-old students**. It is an excellent example on how to introduce bioeconomy as a project in the classroom.



Gahlawat, P., Liadaki, K., Papageorgiou, E., Siotou E. (n.d). *Bloom your school with your biofuel and a soap lab*. <https://bloom-bioeconomy.eu/wp-content/uploads/2019/07/BLOOM-LS-TEAM1-Bloom-your-school-online.pdf>

This Learning Scenario aims at an overarching understanding of bioeconomy by **connecting everyday life examples to the topic** at hand, then developing further into an entire project. First, learners create a poster on bio-based products they found in the market. Then, they are involved in experimental laboratory work. Students conduct three experiments, collect data and make conclusions according to the instructions. Finally, students should produce a 1-minute-long creative advertisement. Can you spot all seven gold standards for a project-based lesson?

In the video below, you can watch the BLOOM expert teachers share their experiences when implementing this Learning Scenario:



Figure 51. European Schoolnet Academy. (n.d.). *BLOOM School Box - Bloom your school with your biofuel and soap lab* [Video]. YouTube. Retrieved from <https://www.youtube.com/watch?v=exampleURL>

3.6.4. Participatory photography

Photography in educational contexts has been shown as a useful tool to bring out moments of reflection, insight and awareness on various topics. It allows students to **capture the reality** around them according to their personal perspective, to **tell stories**, and **gain awareness** about critical issues and strengths of their community.

Participatory photography can stimulate student to bring out a theme to be **developed, communicated and investigated**. It allows them to develop a relationship with places, times and people while raising awareness and inspiring real social change.

Participatory photography can be used to **engage students** in the opportunities of circular bioeconomy in their everyday context. Through photographs (and/or video recordings), students can become aware of the numerous and concrete applications of the bioeconomy, collecting virtuous **examples existing in their everyday contexts**, and stimulating sustainable choices through a critical and conscious gaze.

In addition, this format allows you to **engage the entire school community**, by organising a school-wide activity of collecting photos of examples of bioeconomy in the school or even by organising photo competitions. The photographs and videos can be displayed in a final exhibition in school.

Explore more how to implement **participatory photography** in your classroom by taking a look at the factsheet developed by the GenB Project:



Figure 52. GenB Project. (2024). Participatory photography to narrate, investigate the circular bioeconomy, and activate our gaze on everyday sustainability [Factsheet]. https://genb-project.eu/app/uploads/2024/08/Factsheets_GENB_JJ_20240808.pdf

3.6.5. Reflection Activity

Teaching bioeconomy in secondary schools comes with unique challenges and opportunities. As students develop a deeper understanding of the world, real-world connections, interdisciplinary teaching, and project-based learning become essential tools in the classroom. Reflect on your experiences with teaching complex subjects like bioeconomy to teenagers. Consider these questions:

1. How have you implemented **project-based learning (PBL)** in your classroom? What projects have worked well to engage students in bioeconomy or other interdisciplinary fields?
2. How have you used **hands-on labs** or **participatory photography** to foster critical thinking and engagement in topics like bioeconomy? Share any specific activities that have resonated with your students.

Post your reflections on [Padlet](#) and take time to review your peers' contributions. Offer feedback or ask follow-up questions to deepen the discussion:

<https://padlet.com/eunacademy/experiences-with-teaching-bioeconomy-to-teenagers-3z6js83hkskfskkj>

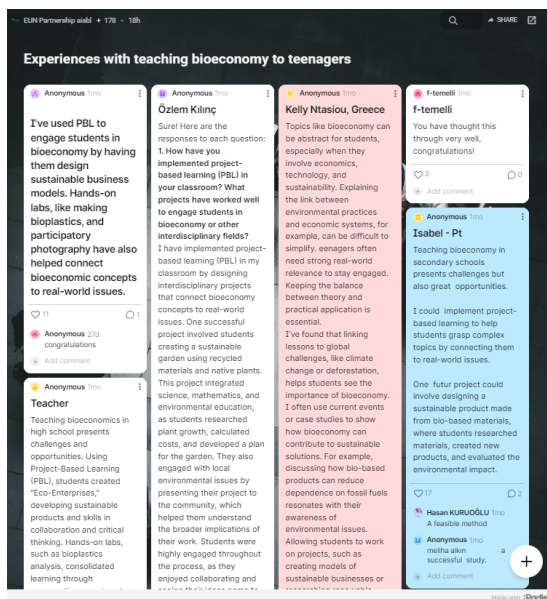


Figure 53. Padlet: <https://padlet.com/eunacademy/experiences-with-teaching-bioeconomy-to-teenagers-3z6js83hkskfskkj>

3.7. Whole school approach and the 7-Step Eco School methodology

3.7.1. Bioeconomy from a Whole School approach

Having had the chance to discuss ways to bring the bioeconomy in the classroom as well as resources to help establish meaningful connections between bioeconomy and various areas in curriculums, in this section we will leave the classroom as a setting, and we will focus on the school as a wider community.

In bioeconomy, as well as in any other topic, **you shouldn't take action alone, but in collaboration with the entire school community**, including school principals, parents and even other schools. As we have learnt already, some projects require the cooperation of different teachers and breaking the boundaries of a specific classroom or subject.

A whole school approach to bioeconomy education **fosters a sense of community and shared responsibility**. By working together on interdisciplinary projects, schools can integrate subjects like biology, chemistry, and economics into initiatives like sustainable gardening. Involving the community, especially **parents**, in school events and projects can help to foster the development, as well as reinforcement of more sustainable habits and choices. Moreover, establishing partnerships with other schools enables sharing of resources, ideas, and successes, creating a larger network of support and innovation.

3.7.2. Introduction to the 7-Step Eco School methodology

The Eco-Schools Seven Steps methodology is a series of carefully engineered measures to help schools maximise the success of their Eco-School ambitions. The method involves a wide diversity of individuals from the school community - with students playing a primary role in the process.

The Eco-Schools programme encourages young people to engage in their environment by allowing them the opportunity to actively protect it. It starts in the classroom; it expands to the school and eventually fosters change in the community at large. Through this programme, young people experience a sense of achievement at being able to have a say in the environmental management policies of their schools, ultimately steering them towards certification and the prestige which comes with being awarded a Green Flag. Check out the presentation on the link: [2.7 Whole school approach and the 7-Step Eco School methodology | Module 2: Bioeconomy in education: Best practices and challenges | Bioeconomy for Educators: Cultivating a Sustainable Future | European Schoolnet Academy](#)

Eco Schools & Bioeconomy



Figure 54. PowerPoint Presentation: Eco Schools and Bioeconomy, GenB Project

Watch the video below, for more information about the Framework and what implementing it can look like.



Figure 55. Introduction video: Eco Schools Programme (ENG Version) (2012), WWFMy. YouTube. Available at: <https://www.youtube.com/watch?v=NynTmgnUmmo>

For more information about the **7-Steps of Eco-Schools Framework's** make sure to visit the [website](#), where you will be able to read more information about each step.

3.7.3. How to implement 7-Step Eco School methodology in your lessons

Implementing the **7-Step Eco-Schools methodology** in your lessons involves integrating environmental education into the curriculum and encouraging students to actively participate in sustainable practices.

To illustrate this, we present you with two lesson plans that will help you implement the 7-Step Eco-Schools methodology.

The first lesson plan is designed for students from the ages 9-13 and it is aimed at introducing them to the idea of using biological resources to produce goods, services, and energy, emphasizing sustainability, renewable resources, and waste reduction. Students will be introduced to the concept of bioeconomy and will brainstorm ideas for sustainable practices in their own lives, learn about eco schools and the 7-step methodology and use it to disseminate their ideas to the school community.



GenB Project. (2024). *Lesson Plan for elementary school*. https://genb-project.eu/genb_toolkit/lesson-plan-for-elementary-school-grades-4-6/

The second lesson plan or general public multipliers, such as non-formal educators, community leaders, environmental activists and parents, focusing on the concept of the bioeconomy and its role in promoting sustainability within their communities through the 7-step Eco-School Programme of FEE. The lesson is aimed at effective communication of the basics of bioeconomy within their communities, while emphasising interactive learning and engagement strategies. It provides tools and insights to help raise public awareness and adoption of sustainable practices. The plan includes an introduction to bioeconomy, discussion on previous knowledge, real-life examples and benefits or challenges related to bioeconomy, introduction to the 7-step methodology with focus to the formation of an ECO-committee and resources for further learning and dissemination.



GenB Project. (2024). *Lesson Plan for multipliers*. https://genb-project.eu/genb_toolkit/lesson-plan-for-multipliers/

To learn more how to implement the 7-Step Eco-Schools methodology in the context of bioeconomy, take a look at the **GenB Training Materials**. They provide detailed descriptions and explanations of each step, linking them explicitly to bioeconomy concepts. Additionally, the material contains series of presentations that offer practical examples and suggestions help you effectively them within the context of the bioeconomy and their educational settings.

3.7.4. Reflective Activity: How sustainable is your school?

To assess your understanding of the 7-Step Eco-Schools methodology and its application, please complete the following activity. This exercise will help you engage with sustainability issues and explore potential solutions.

Instructions:

- **Find a problem** – Identify a specific sustainability challenge within your school or community. For instance, you might observe issues like excessive food waste in the school cafeteria, a shortage of green spaces for recreation and learning, or the widespread use of single-use plastics. Describe the problem in detail, including its causes, the groups or areas affected, and the potential long-term consequences if left unresolved. This context will help in understanding the importance of finding a sustainable solution.
- **Provide a Solution** – Propose a potential solution for the identified problem. Explain how your solution could be implemented and its expected impact.
- **Engage with Others:** review the problems and solutions shared by other participants on the Padlet.
 - Add ideas on how the problems can be further addressed or solved.

- Highlight potential obstacles or setbacks that might come up in solving these problems.

Share your thoughts on the **Padlet** below: <https://padlet.com/eunacademy/activity-how-sustainable-is-your-school-m4azjsqz3o8o3nti>

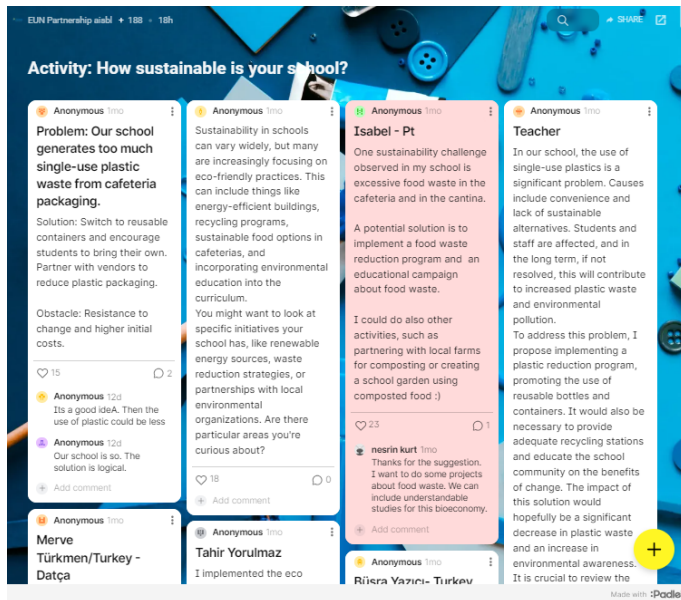


Figure 56. Padlet: <https://padlet.com/eunacademy/activity-how-sustainable-is-your-school-m4azjsqz3o8o3nti>

3.8. Preparation of the Final Assignment

3.8.1. Fill in your GenB Learning Scenario

In the previous module, you became familiar with the [GenB Learning Scenario template](#). Let's review a few important sections of the document that will help us shape your Learning Scenario.

By the end of this module, you may have more ideas about your Learning Scenario. The objective of this weekly activity is for you to share a final and complete Learning Scenario with your peers by the end of the course, so it can be reviewed by other teachers.

For this module, you only need to start considering **the following four sections**:

- Aim of the lesson
- Educational trends
- 21st Century skills
- STEM Strategy Criteria

Refer back to the template to understand these sections. Do you already have any ideas about the activities you will include?

You can get inspired by consulting again these two examples:

- [LS example for primary school teachers.](#)
- [LS example for secondary school teachers.](#)

3.8.2. TeachMeet

Join Our MOOC TeachMeet “Bioeconomy in the classroom: Teachers present their Learning Scenarios” – Share and Learn!

We are excited to announce the TeachMeet event, happening during the 4th week of the MOOC on **Wednesday, 06.11.2024, from 17:00 to 18:00 CET (Brussels time)**.

A TeachMeet is an informal way of sharing ideas, good practices, lesson plans, and more. We use Microsoft Teams as a meeting room. It's also a fantastic opportunity to network with other teachers and educators! Save the date for this special session where you will exchange with your peers, share best practices, and discover great ideas for your **Learning Scenario**. At the end, there will be time for a Q&A session, giving you the chance to ask questions to the speakers.

- **Interested in being one of our 6 speakers?** You will have **around five minutes** to present your experience related to **bioeconomy**. Apply here: [Speaker Application Form](#).
- **Prefer to attend as an attendee?** Then save the date and we will send you the link to join the meeting room!

We can't wait to learn from you and see you at the TeachMeet!

3.8.3. Module Summary

Let's try to recap everything we learned in this module:

Introduction to Bioeconomy in Education

- **Concept:** Bioeconomy uses biological resources for sustainable solutions. Educators need to make this concept accessible and relevant by connecting it to real-world applications.

Educational Approaches and Tools

- **Contextualization and Interdisciplinarity:** Utilize real-world connections, project-based learning, interdisciplinary methods, career exploration, and hands-on experiments to teach bioeconomy.
- **Inquiry-Based Learning:** Students actively participate in the scientific method, from posing questions to presenting findings.
- **Project-Based Learning:** Focus on student-driven projects with real-world relevance and public products.
- **Living Labs:** Co-create solutions with real users in real-life contexts, involving stages like co-creation, exploration, experimentation, and evaluation.

Whole School Approach

Integrate bioeconomy across all subjects and engage the entire school community, including parents and other schools, in projects like composting and waste reduction.

3.8.4. Module Round-up



Great work! You have made it through Module 2!



You have gained an insight on how to include bioeconomy in the classroom as well as an overview of available materials that you could use for this purpose.



You have identified the different ways in which you can include the topic on bioeconomy in the existing curricula and enrich your lessons.

Keep up the good work!

4 Module 3: Bioeconomy in education: Best practices and challenges

4.0. Module introduction





4.0.1. Module introduction



In the previous module, we discovered the GenB Project's toolkits, and a collection of Learning Scenarios developed by expert teachers: we learnt about bioeconomy in interdisciplinary, the whole-school approach, and about implementing this topic using project-based learning and inquiry-based learning.

In the third module of this course, participants will discover what bioeconomy means for the future of your students: we will discuss jobs in the bioeconomy sector and how to encourage school-industry collaboration in this interesting field.

In this module, participants will:

-  **Explore** how to use bioeconomy to connect STEM teaching with everyday life, by examining real-world applications and examples.
-  **Define and explore** careers in bioeconomy by identifying the sector and related industries, and discussing their relevance for future job markets.
-  **Critically reflect** on the approaches to discuss and introduce different careers in your classroom, by considering the needs and interests of your students.
-  **Identify** the importance of building teacher competences related to bioeconomy by understanding how this field impacts education.

Ready to start? Click on "Next"

4.0.2. TeachMeet reminder

Join Our MOOC TeachMeet "Bioeconomy in the classroom: Teachers present their Learning Scenarios" – Share and Learn!

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We can't wait to learn from you and see you at the TeachMeet!

4.0.3. Tell us what you think!

Before you continue, please take a moment to [fill in this survey!](#)

You can also scan the QR Code:



Figure 57. Fill in the GenB Survey: http://52.178.149.72/online.php?pid=MOOC_2

4.1. The bioeconomy Spectrum

4.1.1. Reflection Activity

The bioeconomy is rapidly transforming industries by integrating biological processes with economic activity. Consider these guiding questions, share your thoughts on Padlet and engage with your colleagues by commenting on at least two other posts:

- Which current industries do you think will be most impacted by the bioeconomy, and how might they evolve?
- What specific skills and knowledge do you believe students will need to develop to thrive in bioeconomy-related careers?
- How can educators prepare students for the interdisciplinary nature of jobs in the bioeconomy?

Share your thoughts on the [Padlet](https://padlet.com/eunacademy/reflection-activity-the-bioeconomy-spectrum-ruel1j0m4lg39vms): <https://padlet.com/eunacademy/reflection-activity-the-bioeconomy-spectrum-ruel1j0m4lg39vms>

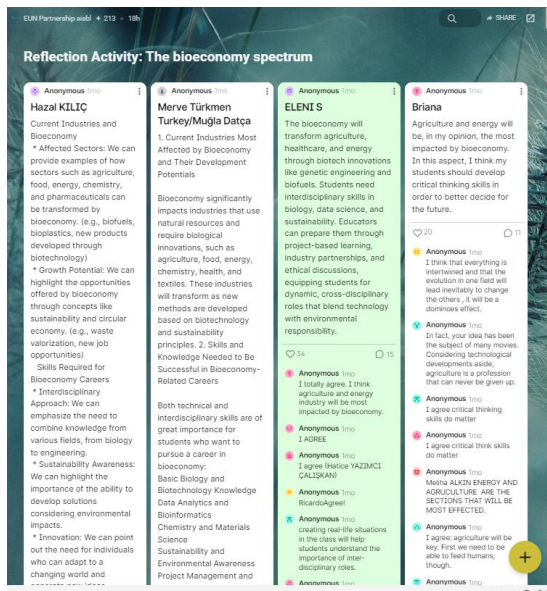


Figure 58. Padlet: <https://padlet.com/eunacademy/reflection-activity-the-bioeconomy-spectrum-ruel1j0m4lg39vms>

4.1.2. Economy and bioeconomy

Economy is a **system of production, distribution, and consumption of goods and services** in a society. It includes various **sectors** and **industries** that contribute to overall wealth and resource management.

Bioeconomy is an innovative segment of the broader economy that integrates biological knowledge and resources to drive sustainable economic growth.



Figure 59. Image by [Orlando](#) from [Pixabay](#)

As our traditional economic systems struggle with the loss of limited resources and environmental damage, **bioeconomy** provides a hopeful solution that **connects economic activities with protecting the environment**. This **balance between the bioeconomy** and the larger **economy** is essential for solving today's big issues, like climate change, resource shortages, and the need for sustainable growth.

In this section of the module, we will uncover some of these opportunities. First, let's explore the landscape of the changing job sector.

4.1.3. Bioindustries

Bioeconomy covers **all stages of production**, starting from **primary sectors** like agriculture and extending to **quinary sectors** like government services. It includes key industries that promote economic growth, protect the environment, and drive innovation. Bioeconomy doesn't just offer more sustainable ways to produce goods and services—it also opens up a wide range of career opportunities in various fields.

Bioindustry, a crucial part of the bioeconomy, refers to the **sector that applies biotechnology to produce goods and services**. **Bioindustries use natural biomass to produce goods and services**.

These industries focus on developing products in areas like food, medicine, energy, and materials in ways that are **more sustainable** and **environmentally friendly**. Instead of relying on non-renewable resources like fossil fuels, **bioindustries aim to harness renewable resources and use technology to create solutions that are better for both the economy and the planet**.



Figure 60. Image by [freepik](#)

For example, bioindustries can turn agricultural waste into biofuels for energy, or use microorganisms to create biodegradable plastics. They work in fields such as biotechnology, agriculture, and pharmaceuticals, and play a key role in the growing bioeconomy, which looks for ways to balance economic growth with environmental sustainability.

One of the key advantages of the bioeconomy sector, especially for creating job opportunities, is that it **helps the development of regions** and **brings economic prosperity to local communities**. For example, establishing a biorefinery in an underdeveloped area can create new jobs, stimulate local businesses, and foster long-term growth where opportunities were previously limited. This makes the bioeconomy a powerful tool for both regional development and sustainable economic progress.

Watch the [video](#) below to see some examples of this from France, Germany or Hungary:



Figure 61. EuropaBio - The European Association for Bioindustries. (2013, May 8). BioBased Economy - Potential in the Land [Video]. YouTube. <https://youtu.be/XX6911pSOKq?si=HO6rZ8WY97SwXNJ>

Reference: Lasarte-López, J. and M'barek, R., Brief on jobs and growth in the EU bioeconomy 2012-2021, Borzacchiello, M. T., editor, European Commission, 2024, [JRC137187](#).

4.1.4. The EU bioeconomy market & employment opportunities?

The bioeconomy sector currently **employs 18 million people** in the EU, as the EU is investing heavily in the bioeconomy to boost job creation and economic growth while achieving its environmental goals, such as the European Green Deal. So, the number is expected to grow, as the bioeconomy sector expands in the coming years.

As the bioeconomy expands, it offers promising career paths in both traditional industries like farming and forestry and emerging fields like biotechnology and renewable energy, appealing to individuals interested in innovation and sustainability.



Figure 62. European Commission. (2022, May 5). Jobs and growth of the EU bioeconomy 2008-2019. YouTube. <https://www.youtube.com/watch?v=-sPBdkvmRWs>

Employment opportunities in the bioeconomy are diverse and can be found across multiple sectors. Some key areas include:

1. Agriculture and Forestry
2. Biotechnology
3. Food industry
4. Renewable Energy*
5. Waste Management
6. Public Policy and Research

On the [Genially below](#) you can explore the different sectors within bioeconomy, focusing on the major advancements and the growing range of job opportunities in this fast-developing field.



Figure 63. Exploring the Sectors of Bioeconomy, GenB Project,
<https://view.genially.com/670cdbf86441ddee274c335d/interactive-content-exploring-the-sectors-of-bioeconomy>

4.1.5. Skills in bioeconomy

The bioeconomy represents a dynamic and evolving field, requiring a diverse set of skills, expertise, and educational paths to cultivate professionals capable of driving sustainable economic growth. This section focuses on the critical skills needed for a career in bioeconomy, emphasizing both general and specific competencies.

On the [Genially presentation](#) below, you can explore the key skills needed for pursuing a career in the bioeconomy, an innovative and rapidly growing field.



Figure 64. Essential Skills for a Career in Bioeconomy, GenB Project,
<https://view.genially.com/670cf2ec454001e4c99dd916/interactive-content-essential-skills-for-a-career-in-bioeconomy>

Understanding these skills is important for you as a teacher because it will help **you guide your students toward future job opportunities** that contribute to a more sustainable economy. By equipping your students with this knowledge, you can inspire them to pursue careers that combine innovation, environmental responsibility, and economic growth, preparing them for success in the evolving job market.

By fostering a balance between general and specific skills, individuals can better position themselves to access and thrive in the innovative and promising bioeconomy market."

4.1.6. Reflection Activity: Assessing Student Skills for Bioeconomy

You have learned about a list of general and specific skills relevant to bioeconomy careers. How is your students' performance on them?

Briefly describe which skills your students excel in and which skills they struggle with. You can include specific examples or observations if relevant.

Tag your post with "Strengths" or "Challenges" to categorize it accordingly.

After sharing your experience, read other participants posts and notice this:

- Which skills are most commonly identified as strengths?
- What skills are most frequently noted as challenges?
- How can we use what students are good at to help them improve in areas where they struggle?

Share your thoughts on the Padlet: <https://padlet.com/eunacademy/reflection-activity-assessing-student-skills-for-bioeconomy-kuwdbwgu2u2mndii>



Figure 65. Padlet: <https://padlet.com/eunacademy/reflection-activity-assessing-student-skills-for-bioeconomy-kuwdbwgu2u2mndii>

4.2. The bioeconomy Spectrum

4.2.1. What can you do in your classroom?

In this section, we'll explore various approaches for discussing careers in the classroom, specifically focusing on careers in bioeconomy. In this unit, we provide you with a general framework for introducing bioeconomy careers to students of all ages.

Career guidance is the process of helping students **understand their interests and strengths**, as well as **explore different career opportunities** to and **choose ones that are the most suitable** for them.

Incorporating career guidance into classroom teaching can be highly beneficial for students. As the world of work becomes increasingly complex, understanding various careers, especially in fields like bioeconomy, can help students make informed decisions about their education, skills development, and future career paths.

Explore the [presentation below](#), to learn about some practical tips on how to effectively talk about careers and inspire your students to pursue.

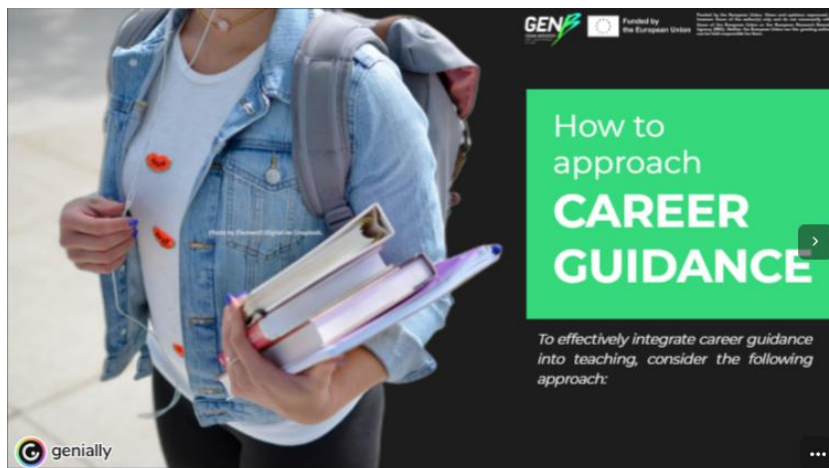


Figure 66. How to approach Career Guidance, GenB Project, Genially, <https://view.genially.com/66ffda57dba5487166d8fcb1/interactive-content-how-to-approach-career-guidance>



For further details and resources on how to introduce STEM related careers in your classroom, refer to the "[Guidelines on how to present STEM jobs in classrooms](#)" and the "[Handbook for Career Advisers](#)" from the STE(A)M IT project.

4.2.2. Career profiles

A **job profile** is a **short description** that summarizes the **expectations, responsibilities, tasks, and requirements of a particular job**. These profiles are essential tools for employment as they help students and professionals understand **job expectations** and **prepare for roles**, assist companies in **talent recruitment, standardise job requirements across the industry**, guide the **design of relevant vocational training and educational programs**, and provide key **insights for policymakers** to develop supportive workforce policies and programs.



Figure 67. Adapted from [BioGov.net](https://www.biogov.net) D2.2 "Description of Job Profiles related to bioeconomy"

Check the following [presentation](#) created by GenB project where they give us a scan of the EU Bioeconomy market and give us details on a few concrete job profiles. Check out the presentation on the link: [3.2 Introducing expertise in the classroom | Module 3: Bioeconomy career awareness and teaching approaches | Bioeconomy for Educators: Cultivating a Sustainable Future | European Schoolnet Academy](#)

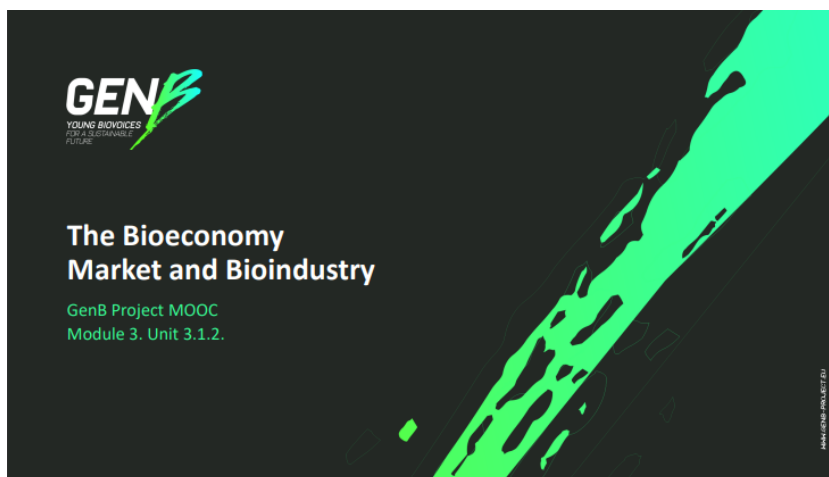


Figure 68. PowerPoint Presentation: The Bioeconomy Market and Bioindustry, GenB Project

Comprehensive studies on bioeconomy job profiles and career pathways are generally missing. However, the BioGov.net (Horizon Europe project) analysis on bioeconomy job profiles is a good starting point to explore bioeconomy careers. For detailed information explore different [career factsheets](#) developed within the [BioGov.net](https://www.biogov.net) project.

Other resources:

- AllThings.BioPro. (n.d.). *Jobs and Careers in bioeconomy*. [Factsheet]. <https://library.genb-project.eu/VLToolkit?id=a030900000TSPuCAAX>
- UrBIOfuture. (2020, July 1). *Why should you pursue a career in bioeconomy?* [Video]. YouTube. <https://www.youtube.com/watch?v=oiISL9-t2cE> and <https://library.genb-project.eu/VLToolkit?id=a030900000TSPzeAAH>

4.2.3. GenB Bioeconomy Job Profiles

The GenB project helps connect students with the bioeconomy sector by sharing [interviews and factsheets from professionals in the field](#). These resources explain different careers, educational paths, and the real-life experiences of bioeconomy experts. By showcasing how these professionals got their jobs and the challenges they face, the project aims to inspire and motivate students to consider pursuing a future in this field.

On the video below check out the interview with Paola Varela, **social entrepreneur and bioeconomist**, as she introduces herself and the path that led her to enroll in a bioeconomy career.



Figure 69. BIOVOICES Project (2023, 20 Dec.). "Bioeconomy Careers and Skills for the Future #2." [Video]. YouTube. www.youtube.com/watch?v=Kr0E96Wqv5k

In addition, check out the career factsheet of this professional and learn more about their career and educational path:

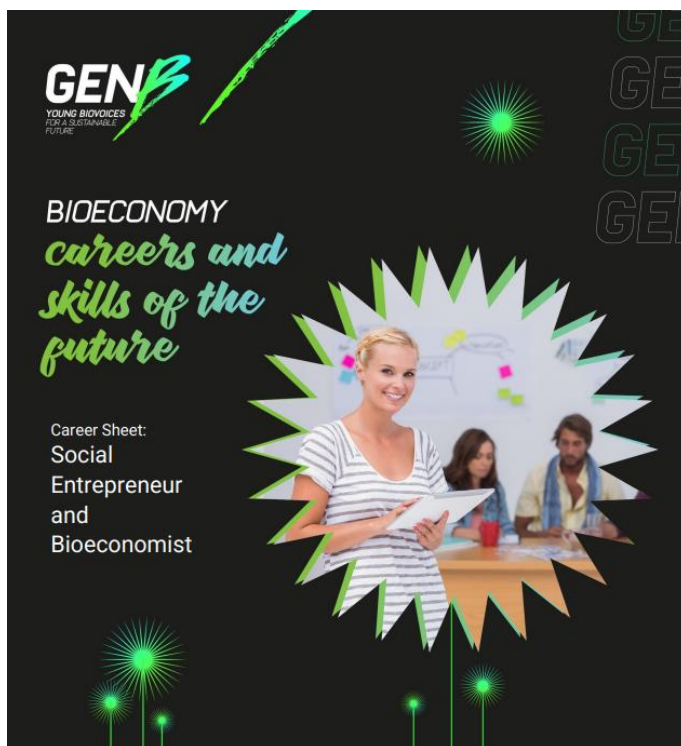


Figure 70. Job Profile: Paola Varela Pérez, Social Entrepreneur and Bioeconomist. GenB Project. https://genb-project.eu/genb_toolkit/bioeconomy-job-profiles-meet-paola-varela/

Explore career profiles of different experts in the field of bioeconomy in different languages:

- [GenB Job Profile: Kateryna Ivanova, Research Fellow/ Research Assistant](#)
- [Job Profile: Paola Varela Pérez, Social Entrepreneur and Bioeconomist](#)
- [GenB Job Profile: Miquel Minquet, Manager in the field of Bioeconomy](#)

4.2.4. What can you do with students from 4 to 13 years old?

The involvement and type of career guidance activities should be tailored to both **the age of the educators and the target audience**. With very young students (from the ages 4 to 8 years old) and in the elementary school (students from 9 to 13 years old) settings, **career guidance is less about introducing specific career paths** and more about **sparking curiosity** and **exploring a variety of fields** and helping students **recognise their strengths and interests**.

At this age, the activities need to be **diverse, playful, and related to students' everyday life**. This way students can keep a high level of interest throughout the lesson. Activities should also aim at **instructional scaffolding**, as well as responding to students' interests to know more about specific jobs.

Activities like art (e.g., drawings), theatrical games (e.g., role-playing or pantomime), or language (e.g., writing interview questions to a professional or guessing words where some letters are missing) integrated with components of STEM can make lessons more attractive and enjoyable to students. Career sheets can also be used to present different jobs starting, for instance, from those jobs performed by students' parents. Students can also look for

different jobs, for example in the field of bioeconomy, complete and present their career sheets to the rest of the class through meaningful activities.

Below you will find some concrete strategies to effectively discuss careers with young students:

- **Foster motivation**
To engage young students, introduce basic concepts about different careers through **playful and interactive activities**. For example, use themes like farms, animals, landscapes, or the ocean to captivate their interests. Using card games such as the **'BioHeroes: Let's Save the Planet!'** game developed by the GenB project, can help students explore these themes and reflect on their own interests and skills.
- **Connect to Curriculum:**
Link career-related topics to the subjects being taught. For instance, connect a lesson about animals to careers in zoology, marine biology or wildlife conservation. Using materials such as **"Business Match"**, can help students make connections and see the relevance of their studies to potential future careers.
- **Create Real-World Connections:**
Share stories or videos about people working in fields related to students' interests. Organize visits to local farms, science centres, or other relevant places to give students a tangible sense of how these fields operate and the impact they have. Using video interviews, such as **"THYME Project interview with a Device Technologist"**, with different experts could foster and spark interest of students.
- **Encourage Participation:**
Encourage active participation by involving students in projects or discussions where they can explore different careers and think about their future. Invite parents who work in interesting professions to talk about their jobs, linking their experiences to the students' learning.

By integrating these approaches, you help young students start thinking about their future in a fun and engaging way. This lays the groundwork for more detailed career exploration in later years and emphasizes their role as active participants in addressing real-world challenges.

4.2.5. What can you do with students from 14 to 18 years old?

During **secondary school education (14-18 years old)**, career guidance becomes significantly more **present and critical**. In most European educational systems, this is the stage where students start making important decisions about their future academic and career paths.

As students begin to define their trajectories, it's essential to highlight **bioeconomy** as a field that offers valuable opportunities for both **higher education** and **immediate entry into the workforce**. The field encompasses a broad range of fields related to sustainability, environmental management, and innovative technologies but it also emphasises practical skills and vocational training.



Figure 71. Image by stodyset on [Freepik](#)

When talking about careers with older students, one of the most common **challenges** that emerges is the **alignment with the school curriculum**. When introducing new content, such as careers in the field of bioeconomy, you should try to **raise awareness** on these occupations by connecting your subject both to **real-world applications** and to professionals who **make use of the skills** they obtain in class.

Demonstrate that **professionals**, no matter their role, **have normal lives**, families, and hobbies – just like your students. Such contextualisation can help them see their learning goals as more attainable, boost their confidence, and improve their overall performance and engagement in different subjects.

To make such connections and deepen students' understanding, you can also incorporate reflective activities in their lessons. For example, you can **ask some open-ended questions** about what they would need to know to become a bioeconomy professional, what skills they will be using if they were working in that field, or the impact that a specific job in bioeconomy would have on their personal lives.

4.2.6. Strategies to talk about bioeconomy with students from 14 to 18 years old

Below you will find some concrete strategies to effectively discuss careers with older students. By integrating these strategies, you can effectively support students in making informed decisions about their academic and career paths. This guidance will help them see bioeconomy as a dynamic field with opportunities to contribute to solving global challenges, positioning them to become active participants in shaping a sustainable future.

- **Align with Curriculum**

To connect career guidance with the curriculum, **demonstrate how subjects** like STEM and other academic areas **relate to real-world careers** in the field of bioeconomy. For instance, illustrate how scientific principles are applied in various professions within the bioeconomy by implementing a Learning Scenario ***'Don't waste your waste! - Raising bioeconomy awareness'*** developed within the **BLOOM Project**. By showing these connections, you help students understand the practical relevance of their

studies and inspire them to see how their academic skills can lead to rewarding careers.

- **Maintain the Motivation**

By showcasing how the bioeconomy addresses pressing global challenges, such as sustainability and resource management, students can see the real-world impact of their work and find motivation in contributing to solutions that could "save the planet Earth." You can include your students in a classroom or a schoolwide activity such as one described in the [‘The benefits of composting- How can we produce organic fertilizer in our school garden’](#) Learning scenario developed within the [BLOOM Project](#).

- **Explore Career Paths**

Provide detailed information about various career paths within the bioeconomy. Use [career sheets](#) and other resources to present comprehensive insights into different roles, including the skills required, daily tasks, and career progression opportunities. Engage students by [inviting professionals](#) from fields like bioengineering, environmental science, or sustainable architecture to speak with them. Virtual meetings or guest speakers can offer valuable perspectives and inspire students by showcasing the diverse opportunities available.

- **Promote Interactive Learning**

Encourage students to engage in experiential learning by incorporating [hands-on projects](#) and inquiry-based activities into lessons. For example, organize projects related to current trends in the bioeconomy or involve students in [citizen science initiatives](#) that tackle real-world problems. Reflective activities are also crucial; prompt students to consider how the knowledge they've gained about various careers aligns with their own interests and aspirations, fostering a deeper connection to their future goals. Consider conducting a long-lasting project-based activities such as a [board games](#) or an [escape room](#).

- **Plan for the Future**

Assist students in **planning their future** by providing information on higher education options and career pathways related to the bioeconomy. Help them understand the steps required to pursue their desired careers, whether through advanced studies or direct entry into the workforce. Look for **career fairs, workshops, and other events** that offer additional information and networking opportunities. These activities will help students make informed decisions and build connections that are crucial for their future success.

4.2.7. Additional resources



Take a look at the Career Chat with Bioeconomy Expert Marjolein Oonk, Technical advisor in sustainability in construction at WAM & VanDuren. The expert connected with secondary school teachers and students offering invaluable insights into this dynamic field.

The expert introduced students to their educational background and professional journey. With a focus on the current processes and activities implemented by the company.



Figure 72. BIOVOICES Project. (2024, September 27). Bioeconomy Career Chat [Video]. YouTube.
<https://www.youtube.com/watch?v=CzHSzBTPbjs>

In the list below you can find additional resources to effectively talk about careers in bioeconomy:

- BIOVOICES Project. (September 2022). *Young Bioeconomy Entrepreneurs* [Playlist]. [Playlist]. YouTube.
<https://www.youtube.com/playlist?list=PLbA125z357wRCKgsNBP8Yskd4kR33MJPO>
- Energy & Environment Institute, University of Hull. (2021a, September 29). *Careers in the Bioeconomy – a THYME Project interview with a Device Technologist* [Video]. YouTube. <https://www.youtube.com/watch?v=-DWbA91SZkQ>
- Energy & Environment Institute, University of Hull. (2021b, September 29). *Careers in the Bioeconomy – a THYME Project interview with a PhD researcher* [Video]. YouTube. https://www.youtube.com/watch?v=O_EZHNvntG4
- BIOVOICES Project. (2022a, September 6). *Young Bioeconomy Entrepreneurs #5 - Meet ReThinkCheese!* [Video]. YouTube. https://www.youtube.com/watch?v=QegE_ZuDvT4
- BIOVOICES Project. (2022b, September 28). *Young Bioeconomy Entrepreneurs #9 - Meet BluuSeafood!* [Video]. YouTube.
<https://www.youtube.com/watch?v=yqUOMMDHqq8>
- STE(A)M IT Project. (n.d.). *Bioinformatician* [Career Profile].
<https://steamit.eun.org/bioinformatician/>

4.2.8. Additional resources

Discuss and explore current practices and potential improvements in career counselling related to STEM topics, with a focus on bioeconomy.

- How does your school currently address career counselling in STEM-related subjects? Is bioeconomy mentioned or included in any way?
- In what ways do you think bioeconomy could be better integrated into your school's career counselling programs? Share ideas on practical steps for incorporating bioeconomy topics.
- After reading other participants' posts about their schools' career counselling practices, provide two suggestions on how they could include bioeconomy in their career guidance efforts.

Share your thoughts on the Padlet: <https://padlet.com/eunacademy/reflection-activity-are-you-ready-to-inspire-your-students-t-zkqxr74ge9erpohw>

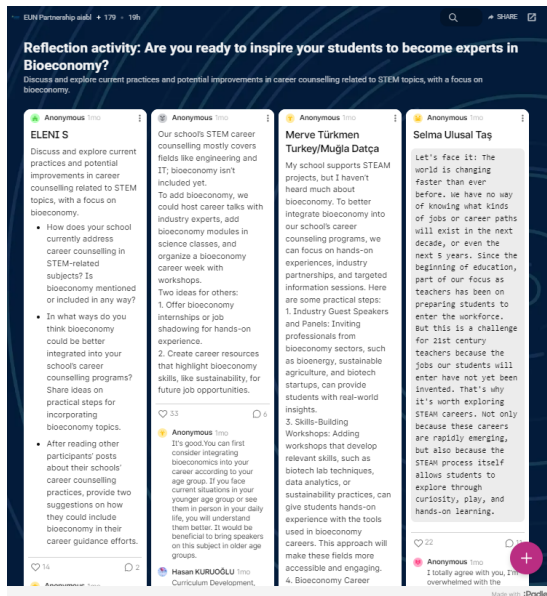


Figure 73. Padlet: <https://padlet.com/eunacademy/reflection-activity-are-you-ready-to-inspire-your-students-t-zkqxr74ge9erpohw>

4.3. Encouraging collaboration with the community

4.3.1. Encouraging school-industry collaboration

Collaboration between schools and **industry** is becoming increasingly common in Europe, particularly within STEM education. This partnership is essential for providing students with a **"real-life" perspective** on how STEM principles are applied in research, industry, and business. By bridging the gap between classroom learning and real-world applications, schools can enhance students' understanding of the importance of STEM subjects for their future careers.

Industry professionals, on the other hand, are eager to engage with schools to fulfil their corporate social responsibility (CSR) commitments, offer internships, and support the development of job-oriented skills. Such collaborations benefit all parties involved, creating valuable opportunities for students to connect academic knowledge with practical experience.

For further guidance on creating effective school-industry collaborations, refer to **'The inGenious Code of Conduct'** by Jean-Noël Colin, John Stringer, and Charmaine Kerr. This European-level guide provides practical principles, guidelines, and checklists to assist schools and businesses in setting up and managing their collaborations effectively.

For more information, visit the inGenious Code [here](http://www.stemalliance.eu/school-industry-collaboration).



Figure 74. Colin, J-N., Stringer, J., Kerr C. (2013). *The inGenious Code of Conduct [Guidelines]*. <http://www.stemalliance.eu/school-industry-collaboration>

4.3.2. Encouraging collaboration with other multipliers

GenB Project has developed a **Toolkit for Multipliers** intended for general public, focusing on the concept of the bioeconomy and its role in promoting sustainability within their communities through the 7-step Eco-School Programme of FEE. Aiming to familiarise an intergenerational audience to the principles of bioeconomy, it provides practical advice on how to integrate those principles in every-day life and community activities while at the same time enhancing the understanding of general public audiences on the 7-steps of Eco-Schools.

The educational toolkit is aimed at creating accessible, engaging, and informative content that can educate and resonate a wide variety of a broad audience, including educators, community leaders, parents and interested individuals with diverse background of knowledge on bioeconomy. It emphasises a user-centered design approach, ensuring that the toolkit is not only informative and relevant but also adaptable to the changing landscape of bioeconomy and sustainability education for the general public.

The content developed includes a [Lesson Plan for Multipliers and general public](#), such as unofficial educators, community leaders, environmental activists and parents. The plan includes an introduction to bioeconomy, discussion on previous knowledge, real-life examples and benefits or challenges related to bioeconomy, introduction to the 7-step methodology with focus to the formation of an ECO-committee and resources for further learning and dissemination. Aimed at enabling participants to effectively communicate the basics of bioeconomy within their communities, the lesson emphasizes interactive learning and engagement strategies, providing tools and insights to foster a broader public awareness and adoption of sustainable practices.



In addition, projects like STEM Alliance, provide a short [guide for schools](#) to foster the development of partnerships with different industries, check it out [here](#).

4.3.3. Organizing Career Activities and Connecting with STEM Professionals

To effectively organize career activities and connect students with STEM professionals and industries, consider the following key questions. Explore the Genially board to find more information: <https://view.genially.com/670d2c1b1e367980f6f7d0fd/interactive-content-organizing-career-activities-and-connecting-with-stem-professionals>

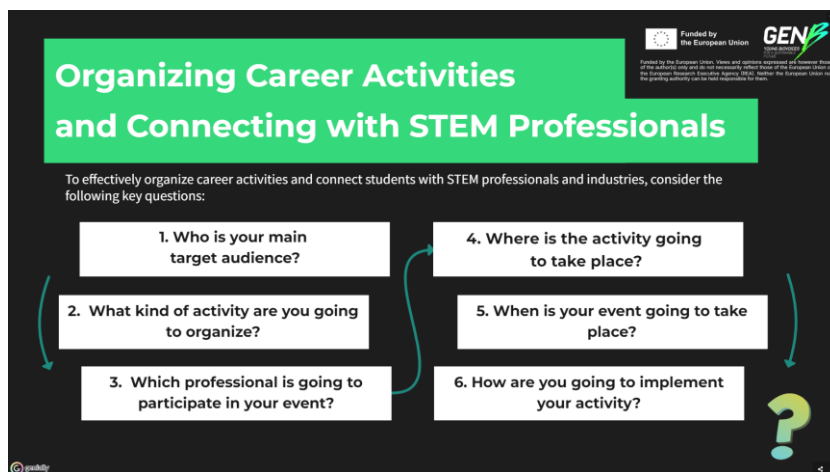


Figure 75. Organising Career Activities and connecting with STEM Professionals, GenB Project, Genially, <https://view.genially.com/670d2c1b1e367980f6f7d0fd/interactive-content-organizing-career-activities-and-connecting-with-stem-professionals>

However, establishing these partnerships can be challenging due to concerns related to ethics, safety, branding, and privacy. Addressing these issues proactively is crucial for overcoming barriers and building successful, mutually beneficial relationships.

4.3.4. Reflection Activity

Is there any organization in your context which you would like to collaborate with? How could such a partnership benefit students' skills in STEM and bioeconomy?

Share below a brief plan on how to connect your school with representatives of the bioeconomy industry! This could happen, for example, within the framework of career day, or field trip.

Share your thoughts on [Padlet](https://padlet.com/eunacademy/reflection-activity-encouraging-collaboration-with-the-commu-nwbhfnfrq4w8wz95) and engage with your colleagues by commenting on at least two other posts. Explore the Padlet: <https://padlet.com/eunacademy/reflection-activity-encouraging-collaboration-with-the-commu-nwbhfnfrq4w8wz95>



Figure 76. Padlet: <https://padlet.com/eunacademy/reflection-activity-encouraging-collaboration-with-the-commu-nwbhfnfrq4w8wz95>

4.4. Preparation for the final course assignment

4.4.1. Your GenB Learning Scenario

During each module, you will be filling in some sections of your GenB Learning Scenario. The objective of this weekly activity is that at the end of the course you are able to share with your peers a final and complete Learning Scenario to be reviewed by other participants of the course.

In the previous module, you started to fill in your Learning Scenario template with the first sections.

In this module, you will focus on:

- Activities
- Assessment

Please note that the “Activities” section is where most of the lesson should be described. Don’t forget that your GenB Learning Scenario should be about bioeconomy:

- Did you include any activity to assess your students starting point?
- Are your activities getting you closer to your original objectives?
- Is your assessment continuous and formative, or is it more summative, like a “final test”?

If you are using any external documents, links or pictures, credit them accordingly! In the Annex, you can add any hand-outs or external documents you’re using, so that your Learning Scenario is one standalone document. This will make your reviewers’ task much easier.

Once you have completed these sections, save the document and keep on working on it during the following modules. **Good luck!**

4.4.2. TeachMeet

Join Our MOOC TeachMeet “Bioeconomy in the classroom: Teachers present their Learning Scenarios” – Share and Learn!

We are excited to announce the TeachMeet event, happening during the 4th week of the MOOC on **Wednesday, 06.11.2024, from 17:00 to 18:00 CET (Brussels time)**.

A TeachMeet is an informal way of sharing ideas, good practices, lesson plans, and more. We use Microsoft Teams as a meeting room. It’s also a fantastic opportunity to network with other teachers and educators! Save the date for this special session where you will exchange with your peers, share best practices, and discover great ideas for your **Learning Scenario**. At the end, there will be time for a Q&A session, giving you the chance to ask questions to the speakers.

- **Interested in being one of our 6 speakers?** You will have **around five minutes** to present your experience related to **bioeconomy**. **Apply here by 27th of October, at 23:59 CET:** [Speaker Application Form](#).
- **Prefer to attend as an attendee?** Then save the date and we will send you the link to join the meeting room!





We can’t wait to learn from you and see you at the TeachMeet!

4.4.3. Module Round-up



Great work! You have made it through Module 3!

During this lesson we learnt that Integrating bioeconomy into education involves developing both general and specific skills in students, connecting curriculum to real-world careers, and fostering collaboration with industry and community. By incorporating interactive and practical learning experiences, addressing stereotypes, and engaging with industry professionals, educators can better prepare students for future careers in the bioeconomy sector. This holistic approach ensures that students are equipped with the necessary skills and knowledge to thrive in an evolving field dedicated to sustainability and innovation.

-  You have **explored** how to use bioeconomy to connect STEM teaching with everyday life, by examining real-world applications and examples.
-  You have **defined and explored** careers in bioeconomy by identifying the sector and related industries and discussing their relevance for future job markets.
-  You have **critically reflected** on the approaches to discuss and introduce different careers in your classroom, by considering the needs and interests of your students.
-  You have **identified** the importance of building teacher competences related to bioeconomy by understanding how this field impacts education.

Keep up the good work!

5 Module 4: Your GenB Learning Scenario

5.0. Module introduction




5.0.1. About this Module



In the previous module, we discussed possible jobs in the field of bioeconomy and how to enhance school-industry collaboration in this sector.

In this concluding module, the focus turns to you! You will finalise and hand in your own bioeconomy activities and review the work of course peers.

By the end of this module, you will:

-  Design and submit a GenB Learning Scenario that effectively incorporates bioeconomy concepts for classroom use by following structured guidelines and aligning with bioeconomy principles presented in the course.
-  Review and provide feedback on at least three peer Learning Scenarios by using provided assessment criteria, ensuring that each scenario meets key bioeconomy and sustainability standards.
-  Participate in a TeachMeet session to exchange ideas and discuss educational strategies for bioeconomy, applying insights gained from this collaborative environment to improve their own Learning Scenario.

Ready to start? Click on “Next”

5.1. Module introduction




5.1.1. Learning Objectives

When designing your Learning Scenario for bioeconomy, it's essential to set clear and actionable learning objectives. Using the SMART framework can help ensure that your goals are specific, measurable, attainable, relevant, and time-bound.



Figure 77. Image by [Freepik](#)

Tips for Writing SMART Objectives:

- **Use Clear Language**
 Start with specific verbs like "analyse," "create," or "describe" to clearly define each objective. For example, "Create a model of a sustainable bioeconomy system."
- **Break Down Large Goals**
 Divide complex objectives into smaller, manageable steps. For instance, first, have students research bioeconomy concepts, then create a poster, and finally present their findings.
- **Review Regularly**
 Continuously assess and refine your objectives based on student progress and feedback to ensure they remain relevant and achievable.

Applying the SMART framework to your bioeconomy lessons will help you set well-defined, actionable learning objectives that enhance teaching effectiveness and support student success in understanding and applying bioeconomy concepts.

5.1.2. Learning Objectives

You got to know what the SMART principle of defining learning goals and objectives, what to consider and how to make your learning objectives clear and easy to track.

Below you can find some tips how to adapt each SMART criterion to the context of teaching bioeconomy. Explore the Genially on the link and click on each of the principles to reveal tip: <https://view.genially.com/671ba045dceb7b89ee71fca7/interactive-content-smart-objectives-for-teaching-bioeconomy>

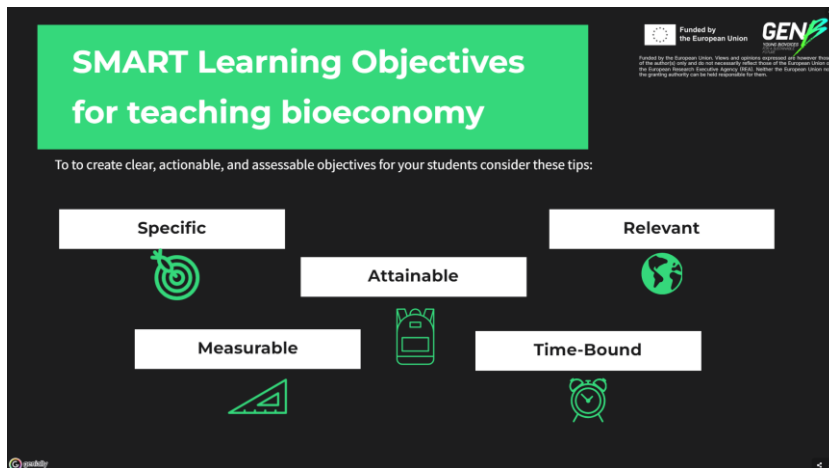


Figure 78. SMART Learning Objectives for teaching bioeconomy, GenB Project, Genially, <https://view.genially.com/671ba045dceb7b89ee71fca7/interactive-content-smart-objectives-for-teaching-bioeconomy>

5.1.3. Assessing learning outcomes

Assessment is the final part of the learning process, although it is more suitable to understand it as a way to improve the whole process. Assessment is important since it is the tool that teachers and students use to judge whether educational needs have been met. There are two main categories of assessment:

Summative assessment	Formative assessment
It is outcome-focused rather than process-focused. This type of assessment provides the means for determining whether your project has reached its goals , objectives, or outcomes.	It is a technique that aims to monitor student learning and provide ongoing feedback that can be used by teachers to improve their teaching and by students to improve their learning.

The balanced use of both summative and formative techniques allows a broader, holistic approach to the learning process and enables improvement at each stage. For example, [the “Building a New Environmental Future” Learning Scenario](#), developed by bioeconomy expert teachers, combines summative and formative evaluation by assessing both a presentation by the students and an evaluation by the teacher.

The difference between **performance-oriented assessment** and **product-based assessment** lies on a similar axis as the difference between summative and formative assessment.

Performance-oriented assessment focuses on the ability of learners to demonstrate their own learning, while product-based assessment focuses on the outcome of the learning process. Both the “[How Poop Will Change the World](#)” and the “[Growing Plastic & New Life for Plastic](#)” Learning Scenarios use product-based assessment.

5.1.4. Assessing learning outcomes

Assess like in a video game!

It is an increasingly mainstream idea among pedagogical experts that the basic structure and assessment method of video games, when implemented in classrooms, can help students experience more success in their learning. How? Explore the genially presentation: <https://view.genially.com/66ffcc38503f89b0cee11f1/interactive-content-assess-like-in-a-video-game>



Figure 79. Applying Video Games Strategies to Assess Students, GenB Project, Genially, <https://view.genially.com/66ffcc38503f89b0cee11f1/interactive-content-assess-like-in-a-video-game>

The above points aim to draw attention to how to create an assessment method in your classroom similar to that of video games. We invite you to consider implementing these steps when assessing your students within the framework of your bioeconomy lesson or project. Watch the video below to learn more about the science behind gaming in education and the theoretical basis of **game-based learning (GBL)**.



Figure 80. TED. (2010, March 17). Gaming can make a better world | Jane McGonigal [Video]. YouTube.

<https://youtu.be/dE1DuBesGYM>

5.1.5. Reflective Activity

Have you tried Game-based Learning Assessment method?

Share your experiences with your peers in the [Padlet below!](#) If you haven't tried it yet, tell us what you think are the advantages and disadvantages of using this method in a science classroom! Explore the Padlet through the link: <https://padlet.com/eunacademy/what-do-you-think-about-game-based-learning-9otc19a7j2alke9i>

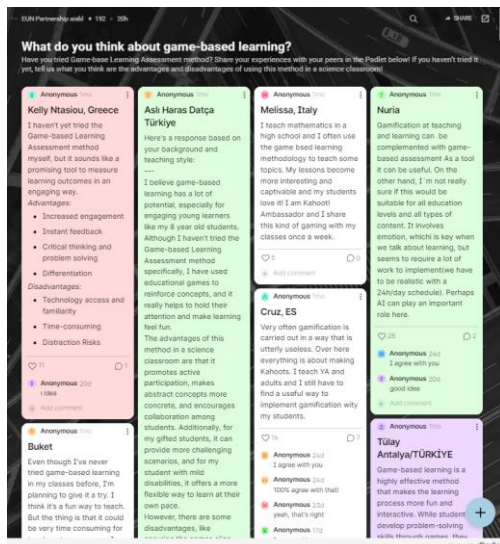


Figure 81. Padlet: <https://padlet.com/eunacademy/what-do-you-think-about-game-based-learning-9otc19a7j2alke9i>

5.1.6. Assessment tools

Digital tools can help change assessment from something teachers do to students into something teachers and students collaboratively construct. Here are some examples of free tools that teachers can use in their classrooms to create digital learning portfolios with their students: Padlet, Evernote, Kidblog. It is also possible to use any other shared platform. The important part is to make it accessible for everyone to contribute.

Another innovative way of assessing students is **peer assessment**, a collaborative learning technique in which students assess their peers' work and have their work assessed by peers. In the video below, John Spencer explains his idea about the **20-minute peer feedback system**:



Figure 82. Spencer, J. (2019, March 3). How to get actionable peer feedback in 20 minutes [Video]. YouTube. <http://www.spencerauthor.com/the-20-m>

The “Bloom your school with biofuel and soap lab” Learning Scenario – among other methods - uses peer assessment: students are asked to create a short advertisement clip which then is assessed by their peers.

Kahoot, Socrative, Plickers and Quizizz all offer a platform that help create engaging assessment. Kahoot is used for assessment in the “Examining thermal properties of biobased building materials” Learning Scenario.

Rubrics are an attempt to create consistent evaluation criteria. They allow teachers and students to evaluate based on complex and objective criteria, and provide a framework for self-evaluation, reflection and peer review. With rubrics, it is possible to deliver a fair and accurate assessment, without actually having to “grade” students.

According to [this article](#), rubrics have many benefits:

- Rubrics guide students and teachers to establish “quality”.
- By using rubrics regularly, students are able to judge their own work better.
- Rubrics reduce the time teachers spend evaluating their students' work and make it easier for teachers to explain to students why they received the mark they did and what they can do to improve.

5.1.1.7. Reflective Activity

Share your experiences with your peers in the [Padlet below!](https://padlet.com/eunacademy/which-of-these-tools-do-you-already-use-in-your-classroom-ca-wv79e6f9m9ozqnh0)

- Which of these tools do you already use in your classroom?
- Can you think of a way to use them to assess bioeconomy lessons?

Share your thoughts on [Padlet](https://padlet.com/eunacademy/which-of-these-tools-do-you-already-use-in-your-classroom-ca-wv79e6f9m9ozqnh0) and engage with your colleagues by commenting on at least two other posts. Explore the Padlet: <https://padlet.com/eunacademy/which-of-these-tools-do-you-already-use-in-your-classroom-ca-wv79e6f9m9ozqnh0>

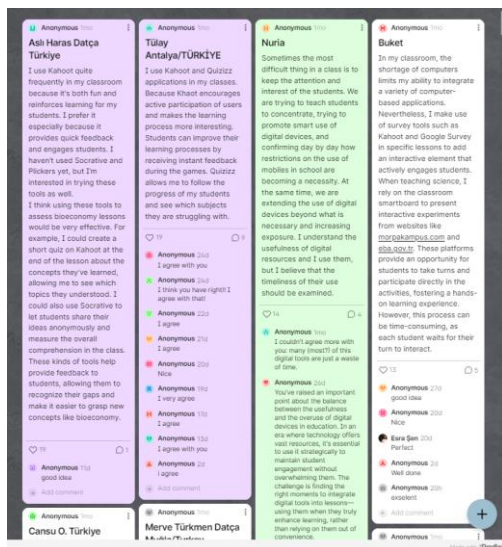


Figure 83. Padlet: <https://padlet.com/eunacademy/which-of-these-tools-do-you-already-use-in-your-classroom-ca-wv79e6f9m9ozqnh0>

5.2. Peer Assessment

5.2.1. Peer-review activity

Peer assessment activities are a central element of European Schoolnet Academy courses.

- On the one hand, these activities are the **only way that learning on MOOCs can be more substantively and qualitatively validated**.
- On the other, they are a mechanism for you to receive more **personalised feedback** on the work you do as part of the course.

Beyond this, the **concept of peer assessment** among teachers is an important idea that we **aim to promote with our courses**. In many countries, teachers still rarely engage in a process of peer assessment. Observing colleagues and giving them feedback is not necessarily a common thing for most teachers. Unlike in the academic community, where peer assessment is one of the main methods for **validating the quality of an academic's work and supporting its further development**, there is nothing equivalent in the teaching community.

However, **we know from research that assessing** someone else's work **can be a powerful learning mechanism** and **exchanging pedagogical practices and ideas** with peers is an **effective way to develop your practice**. Therefore, by using peer assessment activities on our courses, **we aim to introduce and normalise the concept in the teaching community**.

"Evidence suggests that the use of peer assessment in teacher education & training has the potential to induce a shift of teachers' beliefs away from teacher-centred pedagogies to more student-centred approaches" (Topping, 2020)

A third and equally important reason why we use peer assessment in European Schoolnet Academy courses, **is because there is a substantial body of evidence that highlights benefits of engaging in a peer assessment process** for the learner. Go to the next unit for a video that outlines some of these benefits.

5.2.2. Peer assessment benefits and guidance on how to approach it

Take a look at the following video, which outlines some of the benefits of using peer assessment and offers some initial advice on how to give feedback as part of the peer assessment. While the context of the video is different from our setting, almost all of its points are equally valid for this course.



Figure 84. MIT Comparative Media Studies/Writing. (2017, January 31). No one writes alone: Peer review in the classroom – A guide for students [Video]. YouTube. <https://youtu.be/tY8CX0J3lLc>

5.2.3. Peer assessment benefits and guidance on how to approach it

You might be asking yourself how we can provide each other feedback if **we come from very different contexts**, e.g., teaching different age groups and subjects.

Of course, it is important to **keep such differences in mind** when providing feedback for your peer(s). However, this **diversity of contexts can also be a key strength** of the feedback offered. An “outsider” can often see opportunities and challenges which an “insider” no longer notices. Many pedagogical practices that work at primary school level can also work at secondary school level and vice versa, even if slight adaptations might be necessary. And by learning from peers teaching other subjects, we can develop a more cross-curricular perspective on our own teaching.

So, how to go about giving feedback to your peers? Here is some more concrete guidance on how to approach the assessment of your peers’ work:

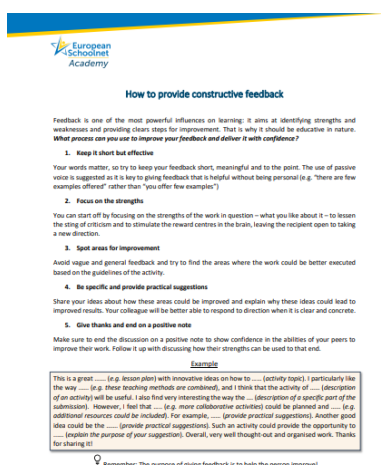


Figure 85. Euepan Schoolnet Academy, How to provide constructive feedback, https://www.europeanschoolnetacademy.eu/downloads/Constructive_Feedback_EUNA.pdf

5.2.4. Practice how to peer assess

Before proceeding with the actual peer assessment, let us first carry out a short practice assessment. [Take a look at the activity here*](#). Make sure to read the full lesson description at the top first, and then focus on the activity shown.

**This is an adapted and shortened activity taken from a lesson plan developed by Barış Ertuğrul. The original lesson plan can be accessed here: <https://v.gd/HI5vV0>*

Go through each of the categories and identify to what extent the lesson plan above addresses the following aspects.

Question 1: Is the lesson well aligned with the general learning objectives?

- **Improvement necessary** - No learning objectives have been defined.
- **Some level of mastery** - The lesson does not link with the defined learning objectives.
- **High level of mastery** - The lesson partly links with the defined learning objectives.
- **Excellent level of mastery** - The lesson clearly links with the defined learning objectives.

Constructive feedback for Question 1: Learning objectives

In the comment box below, please explain why you selected that option for this criterion. Please keep in mind that you need to provide constructive feedback to your peer, and your answer cannot be shorter than 200 characters.

Question 2: Is the lesson clear, relevant, and appropriate and thereby ready for implementation?


- **Improvement necessary** - The lesson is not at all clear, appropriate in length nor appropriate for the age group indicated. A comprehensive redrafting is required for it to be implemented.
- **Some level of mastery** - The lesson is only in parts clear, appropriate in length and appropriate for the age group indicated. It requires substantial adjustments to be implemented.
- **High level of mastery** - The lesson is mostly clear, appropriate in length and appropriate for the age group indicated. With minor adjustments it can be implemented.
- **Excellent level of mastery** - The lesson is fully clear, appropriate in length and appropriate for the age group indicated. It can be implemented without any further development.

Constructive feedback for Question 2: Implementation

In the comment box below, please explain why you selected that option for this criterion. Please keep in mind that you need to provide constructive feedback to your peer, and your answer cannot be shorter than 200 characters.

5.3. Peer assessment activity

5.3.1. Peer assessment activity instructions

 The final peer-to-peer activity has **3 steps**, to be completed in order. Each next step will become available when you finish the previous one. But remember, the deadline to finish the peer-to-peer activity (including your response and peer assessment) is **Wednesday 20 November, at 23:59 CET**. If you have any questions about the peer assessment, please visit [Knowledgebase / Peer review section](#) or post your questions in the dedicated [Discussion Category "Peer Assessment Support"](#).

*Before we start, we want to remind you that as a participant in this course, we expect to see your own unique ideas shine through! If you wish, feel free to use AI tools just like you would seek a friend's help – for discussing ideas or proofreading. The key is to keep your thoughts original while acknowledging how AI can enhance your learning journey. However, it is crucial to use AI responsibly and ethically which means that you need to adjust the AI-generated output to ensure the work is yours and suits your context and objectives, rather than merely copying and pasting the AI-generated answer. Furthermore, **if you use AI, it is essential to disclose how it has been used** to whoever sees the output, unless the final result is significantly edited and can be considered an entirely new work. Please be aware that if these rules are not followed, the submitted work may count as a case of plagiarism which will result in disqualification from receiving the certificate. Any suspected misuse of AI will be carefully investigated by our team upon which a decision will be reached and communicated to any affected users.*

Step 1 – Submit your Learning Scenario

Over the last weeks, we have guided you to work on your learning scenario. By now, you should have finished filling in all parts. If you have not completed your Learning Scenario yet, please, do so now. Your Learning Scenario **must be in English and you must use [the GenB learning scenario template](#)**, otherwise, it will not qualify for the course certificate.

Important note: To upload your learning scenario please follow these steps:

1. Below the responses field, select **Choose Files**.
2. In the dialog box that opens, select the file that you want to upload, and then select **Open**.
3. In the box next to your document, enter a written description of the document. This step is required to help learners understand and evaluate your learning scenario. The Upload file button will not activate until you enter a description in the **Describe field**.
4. Across from the Choose Files button, select **Upload file**.
5. You can delete files once they've been uploaded by clicking the "Delete File" button next to each uploaded file.

- When you have finished uploading your learning scenario, select **Submit your response and move to the next step**. Then click **OK** on the dialog box to confirm.

Step 2 - Review Peers' Learning Scenarios

In this section, we ask you to review the work of your course peers [through the rubric](#) that we had a closer look at in module 1. As you know, the rubric consists of several criteria, a set of options for each criterion and a text box for written feedback. Go through each of the categories and identify to what extent the activity masters the particular aspects.

It is crucial that you **provide fair, encouraging and helpful feedback** that allows your peers to improve their LS. **When you review a Learning Scenario, you evaluate each criterion, select (X) the option that best describes how well the response met that criterion and provide written feedback for each criterion.** Please have a look at ["How to provide constructive feedback"](#) first. In the text box explain why you choose that level of mastery. What areas would you identify as strengths? What areas do you feel could be improved? What would you like to know more about?

Important note: the peer assessment activity is a time for you to share your LS and to provide **constructive feedback to your peers**. Therefore, feedback such as "Thank you", "Well done", "Congrats", etc. is not constructive feedback and as such is **not eligible for the course certificate**. Additionally, your **feedback has to be in English**, otherwise, it will not qualify for the course certificate. Like in the practice peer assessment, you need to provide constructive feedback to your peer, and your answer **should not be shorter than 200 characters for each criteria**.

If one of the works you have been assigned to review is of low quality, missing, plagiarised or otherwise non-compliant with the instructions, please select **"No"** in response to the final rubric question, "In general, does the activity meet the aforementioned requirements?" Then the course team will evaluate your colleague's submission and possibly withhold their certificate.

You will need to **review 3 Learning Scenarios of your peers**. You will receive your peers' Learning Scenarios one by one, meaning, once you review the first Learning Scenario, the second will become available. Once you are done evaluating the second Learning Scenario, the third Learning Scenario will become available.

Step 3 - The Feedback from your Peers

When the peer review is complete (that is, when you have finished evaluating all three Learning Scenarios), **you can see the feedback you received from the peers who reviewed your Learning Scenario**.

After you carefully read the instructions in steps 1 and 2 and complete the assigned activities, we now invite you to proceed and check the feedback you received from the peers who reviewed your GenB School Learning Scenario. **Try to review in a neutral way, where you**

critically look on your Learning Scenarios and compare it with the peer-assessment feedback you received.

Your peers' suggestions can help bring about new ideas, show other perspectives and ways of improvement. We wish you a wonderful and constructive experience with this process.

You have done an amazing job until here! Good luck with the Peer Assessment Activity!

5.4. Congratulations! What's next?

5.4.1. Tell us what you think!



If you're not able to see the embedded survey below, please use the following link: <https://www.surveymonkey.com/r/genb-mooc-post>. This survey will take approximately 5 minutes to complete. Thank you for your participation!



Bioeconomy for Educators: Cultivating a Sustainable Future - Post-course survey

Introduction

Dear participant,

This survey is for enrolled participants of the course "Bioeconomy for Educators: Cultivating a Sustainable Future", offered by GenB on EUN Academy. We aim to collect your feedback and suggestions to consider them when developing future courses.

This MOOC has been developed as part of the GenB project, funded by Horizon Europe, the European Union's funding programme for research and innovation, that runs from November 2022 until April 2025. It is focused on educating and empowering the Generation Bioeconomy (GenB), aware, sensitive, and interested in environmental issues, sustainability and circularity. It aims to raise awareness on Bioeconomy building on communication and education that encourage and reward young BIOVOICES to take a role in steering the transition towards more sustainable lifestyles.

Scientix®, the community for science education in Europe, promotes and supports a Europe-wide collaboration among STEM teachers, education researchers, policymakers and other STEM education professionals.

Data handling:

The data from the survey will be handled according to the European Schoolnet Academy's privacy policy. If you proceed with filling in the survey, you agree with how we handle the submitted data and agree that:

- any information you provide will be anonymously stored and handled;
- your participation in the survey is voluntary and you can withdraw at any time;
- you have received adequate information about your participation in this survey.

Further information:

For any questions regarding the MOOC, please contact: isidora.salim@eun.org
For any questions regarding how your data is handled, please contact: privacy@eun.org

If you understand the information above and wish to continue with the survey, please click "Next".

Next

Figure 86. European Schoolnet MOOC Survey, <https://www.surveymonkey.com/r/genb-mooc-post>

5.4.2. Tell us what you think!



Tell us what you think about the GenB MOOC and fill in the GenB Project Survey, please use the following link: http://52.178.149.72/online.php?pid=MOOC_3. This survey will take approximately 5 minutes to complete.

Thank you for your participation!

5.4.3. Module round-up



In this module, you finalised and submitted your own bioeconomy Learning Scenarios while engaging in peer review to enhance your understanding and application of bioeconomy principles.



The module emphasised the importance of designing clear, actionable learning objectives using the SMART framework, fostering effective assessment techniques—including both formative and summative methods—and promoting collaborative learning through peer assessment.



You also had the opportunity to exchange ideas during a TeachMeet session, aimed at sharing best practices and refining their Learning Scenarios based on feedback.

5.4.4. Congratulations!



Congratulations! You have finished *the "Bioeconomy for Educators: Cultivating a Sustainable Future!"* MOOC.



We hope you have enjoyed this learning journey and that you feel more ready to take on the task of transforming your schoolyard into a nature-based climate shelter!

You have explored stage by stage the design thinking approach, took inspiration from real-world examples by observing what has happened in selected case studies, brainstormed actions and possible steps, created a first draft of a GenB Learning Scenario, and benefited from peer review activities that will hopefully refine your future work significantly!

In order to receive a course certificate, you need to submit your GenB Learning Scenarios and review three Learning Scenarios of other participants! If you have met all the course requirements before the deadline, then you should see a **"Request certificate"** button at the top of your [Progress tab](#). Simply click that button to get your certificate.

If you have not met the course requirements yet, you can do so by **Wednesday 20 November, at 23:59 CET**. In order to earn a course certificate, you need to submit your Learning Scenario and review three LSs of other participants!

We are looking forward to seeing what your bioeconomy lessons will look like! Get to work!
Well done!

GEN

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