GENB
YOUNG BIOVOICES FOR A SUSTAINABLE FUTURE

D1.3 Deliverable

Toolkits for young people, teachers and other multiplayers

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

OUR CONSORTIUM

APRE Agenzia per la Promozione della Ricerca Europea
btg biomass technology group
LOBA®
PEDAL CONSULTING
European Schoolnet
ZSI
aiju INSTITUTO TECNOLÓGICO DE PRODUCTO INFANTIL Y OCIO
Q-PLAN INTERNATIONAL
FVA NEW MEDIA RESEARCH
Hellenic Society for the Protection of Nature

Funded by the European Union

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Deliverable title	Toolkits for young people, teachers and other multiplayers
Deliverable number	D1.3
Deliverable version	1.0
Contractual date of delivery	April 2024 (M18)
Actual date of delivery	30/04/2024
Nature of deliverable	Report
Dissemination level	Public
Work Package	WP1
Task(s)	T1.4
Partner responsible	AIJU
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Revision History

VERSION	DATE	REVIEWER	MODIFICATIONS
0.1	15/02/2024	Clara Blasco (AIJU)	Template
1.0	17/04/2024	Clara Blasco (AIJU)	First draft
2.0	24/04/2024	Katharina Handler (ZSI), Juliet Tschank (ZSI)	Peer review
3.0	26/04/2024	Clara Blasco (AIJU), Pablo Busó (AIJU)	Feedback Incorporation
3.0	30/04/2024	Chiara Pocaterra (APRE), Flavia Fusconi (APRE), Laura Mentini (APRE) and Sara Silvi (APRE)	Final Revision

Table of Abbreviations and Acronyms

Abbreviation	Meaning
AIJU	ASOCIACIÓN DE INVESTIGACIÓN DE LA INDUSTRIA DEL JUGUETE CONEXAS Y AFINES
APRE	Agency for the Promotion of the European Research
BIOVOICES	H2020 project, GA No. 774331, https://www.biovoices.eu/
BIOWAYS	H2020 project, GA No. 720762, https://www.bioways.eu/
BLOOM	H2020 project, GA No. 773983, https://bloom-bioeconomy.eu/
BTG	BTG BIOMASS TECHNOLOGY GROUP BV
DE	German
DoA	Document of Action
EN	English
EU	European Union, or EU-wide (aka Pan-European)
EUN	EUN Partnership AISBL
FEE	Foundation for Environmental Education
FVA	FVA SAS DI LOUIS FERRINI & C
GA	Grant Agreement
GBL	Game-based learning
H2020	Horizon 2020
HSPN	HELLENIC SOCIETY FOR THE PROTECTION OF NATURE
IPR	Intellectual Propriety Right
IT	Italy
LOBA	GLOBAZ, S.A.
MOOC	Massive Open Online Course
n.a.	Not applicable
NL	The Netherlands
PEDAL	PEDAL CONSULTING SRO
PT	Portuguese
SK	Slovakia
SP	Spanish
STEM	Science, Technology, Engineering, and Mathematics
STE(A)M IT	Erasmus+ project, GA No. 612845, steamit.eun.org/
T	Task
TRANSITION2BIO	H2020 project, GA No. 101000539, www.transition2bio.eu/
WP	Work Package
y.o.	Years old
YP	Young people

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1 Executive Summary

This document presents deliverable D1.3, stemming from task 1.4 of WP1 of the GenB project which aims to promote awareness, information and education on the bioeconomy and sustainability. Task 1.4 is dedicated to the development of a series of educational toolkits that address the needs of different audiences, from young pupils to educators to promote a deeper understanding and engagement with bioeconomy concepts.

In line with the EU Bioeconomy Strategy 2018 and the European Green Deal, Task 1.4 aims to contribute to a climate neutral Europe by 2050. Using different educational strategies and materials, this task promotes bioeconomy education, facilitating sustainable production, consumption and lifestyle changes across different demographics.

The GenB toolkits are a set of educational resources designed to facilitate understanding and learning about the bioeconomy and related topics. 6 toolkits have been developed, one intended to pre- and early- school students (4-8 y.o.), elementary school students (9-13 y.o.), high school students (14-19 y.o.), teachers, multipliers and for boosting collaboration among teachers, parents and youth. The grouping of resources according to each of the 6 target audiences forms each of the 6 toolkits developed.

Each of the toolkits consists of a selection of tools for that target group. The resources developed include a book for kids, games and gamified educational experience, quizzes and educational cards, video teasers and educational videos, quizzes and educational cards, contest, online factsheets, hands-on experiments, fairy tale, participatory photography, podcast, educational and information packages, lesson plans, training contents and a MOOC, aimed at different target groups. In addition, a gamified educational experience, hands-on experiments, a tale, participatory photography and podcast have been developed or are being fully develop.

This document provides the first version of these toolkits and tools, enriched with additional materials beyond the original scope reflecting the commitment and innovation of the consortium partners. It provides a concise overview of each toolkit, organised by target audience, and details the types of content, methodological approaches and languages availability.

2 Introduction

2.1 Background on the GenB project

The GenB project aims to raise awareness of the bioeconomy through communication and education initiatives that inspire young people to actively participate in the transition to sustainable lifestyles. Through the use of innovative educational initiatives, GenB aims to foster a proactive approach among young people, empowering them to make informed decisions and drive positive change in their communities. In addition, the project emphasises collaboration between young people, teachers, parents and other multipliers to increase the effectiveness of its educational efforts. This collaborative approach aims to integrate awareness and understanding of the bio-economy, environmental issues, sustainability and circularity into everyday learning and life, promoting sustainable production, consumption and lifestyle choices in wider communities.

2.2 WP1 Objectives

The primary objective of WP1 is to develop and improve awareness, information and education on bioeconomy and sustainability by:

- Exploring and mapping existing awareness, information and education contents (T1.1)
- Making this content easily accessible through an online repository (T1.2)
- Co-creating innovative approaches with diverse actors to raise awareness and teach about the bioeconomy, environmental issues, sustainability and circularity (T1.3)
- Developing educational toolkits for all the GenB targeted ages, teachers and other multipliers (T1.4)

2.3 T1.4 Objectives

Task 1.4 “Toolkits for young people, teachers and other multipliers” focusses on the development of a series of GenB toolkits tailored to six target groups: Pre- and Early- school students (4-8 y.o), Elementary school students (9-13 y.o.), High school students (14-19 y.o.), teachers, multipliers and fostering the collaboration among teachers, parents and youth.

2.4 Structure of the deliverable 1.3

This deliverable is structured according to the target groups: Pre- and Early- school (4-8 year-olds), Elementary school (9-13 year-olds), High school (14-19 year-olds), teachers and multipliers. Each section corresponding to the toolkit developed for each target group and contains detailed presentations of the tools developed specifically for that target group. The sections within each sub- section include:

1. Introduction: An overview of the tool and its purpose.
2. Methodological approach: Describes the development process within the framework of the task.
3. Developed materials: Details of the status and specificities of the material.

4. Expected final outcomes: Outlines the expected results upon completion, including justifications for any deviations and descriptions of further work needed. This subsection addresses how any pending issues or enhancements will be managed in future updates of the toolkit.
5. Language versions: Information on the languages in which the tool is available.
6. Conclusion: Provides a summary of the impact and relevance of the tool.

For an easy consultation of the deliverable, each tool developed has been assigned a code:

1. Books for kids (T1.4 a)
2. Video teasers and educational videos (T1.4 d1, T1.4 d2, T1.4 d3)
3. Educational board game (T1.4 b1)
4. Gamified educational experience "Escape4Future - Chemistry meets Circular Bioeconomy" (T1.4 b2)
5. Role play card game "BioHeroes: Let's save the planet!" (T1.4 b3)
6. Hands-on experiments (T1.4 j)
7. Fairy tale (T1.4 k)
8. Participatory photography (T1.4 l)
9. Podcasts (T1.4 m)
10. Quizzes and educational cards (T1.4 c)
11. Online factsheets "bioeconomy job profiles" (T1.4 e)
12. Educational and information packages (T1.4 f1, T1.4 f2, T1.4 f3)
13. Lesson plans (T1.4 g1, T1.4 g2)
14. Training contents (T1.4 h)
15. MOOC (T1.4 i)
16. Contest "The (shitty) Golden Ticket" (T1.4 n)

In Appendix 1 is shown the table summarising the materials developed organised by target group.

The additional materials developed not initially foreseen in the Document of Action (DoA) which are added in this version of the GenB toolkit are the following:

- Gamified educational experience "Escape4Future - Chemistry meets Circular Bioeconomy" (T1.4 b2)
- Hands-on experiments (T1.4 j)
- Fairy tale (T1.4 k)
- Participatory photography (T1.4 l)
- Podcasts (T1.4 m)

2.5 Scope of the deliverable D1.3

The materials developed in the GenB toolkit fall under task 1.4, task 2.2, as well as derive from developments from the results of task 1.3. As stated above, other materials were not foreseen in the project. Table 1 shows the origin of each material developed.

Identification code	Material developed	Origin
T1.4 a	Books for kids	T1.4
T1.4 d1, T1.4 d2, T1.4 d3	Video teasers and educational videos	T1.4
T1.4 b1	Educational board game	T1.3, T1.4
T1.4 b2	Gamified educational experience "Escape4Future - Chemistry meets Circular Bioeconomy"	T1.3
T1.4 b3	Role play card game "BioHeroes: Let's save the planet!"	T2.2
T1.4 j	Hands-on experiments	T.1.1, T1.3 and T1.4
T1.4 k	Fairy tale	Interactions with teachers in GenB and previous projects
T1.4 l	Participatory photography	T1.3
T1.4 m	Podcasts	n.a.
T1.4 c	Quizzes and educational cards	T1.4
T1.4 e	Online factsheets "bioeconomy job profiles"	T1.4
T1.4 f1, T1.4 f2, T1.4 f3	Educational and information packages	T1.4
T1.4 g1, T1.4 g2	Lesson plans	T1.4
T1.4 h	Training contents	T1.4
T1.4 i	MOOC	T1.4
T1.4 n	Contest "The (shitty) Golden Ticket"	T1.4

Table 1. Origin of the materials developed

This report presents the tools developed to date but anticipates the need for an updated version of the deliverable, scheduled for December 2024. This second version will be dedicated to the finalisation of the pending materials, the exhaustive validation of the scientific-technical content, as well as the complete translation into nine additional languages. In addition, other materials developed outside of the initial commitment will be included, thus ensuring comprehensive coverage and greater accessibility of educational resources in the context of the GenB project.

2.6 GenB toolkit development protocol

The overall protocol for developing the tools followed a systematic process involving several key stages (Figure 1).

Figure 1. Flow of the GenB toolkit tool development protocol

First, content development was carried out, where the GenB toolkit materials were developed. Subsequently, each piece of content was reviewed by the consortium to ensure its quality and consistency. This was followed by a scientific-technical validation by the BTG partner and, in some cases, with external experts, to ensure the accuracy and relevance of the information provided. Once these stages were completed, the materials were translated into different languages to broaden their scope. Finally, layout was carried out by LOBA, ensuring that the materials were presented in a visually appealing and accessible way. Although there is a general development protocol, each tool followed a process adapted to its specific peculiarities.

Importantly, the process involved multiple sub-steps with the participation of diverse people from both inside and outside the organisation, ensuring a diversity of perspectives and quality in the development of the tools that make up the GenB toolkit.

3 Toolkits for Pre- and Early- school (4-8 y.o.)

The toolkit for young people in Pre- and Early school consists of a total of seven new materials. They are identified in Task 1.4 as follows:

- Task 1.4 a: Book for kids “What’s Bioeconomy”
- Task 1.4 b3: Role play card game “BioHeroes: Let’s save the planet!”
- Task 1.4 d: Video teasers and educational videos for 4-8 y.o.
- Task 1.4 j: Hands-on experiments
- Task 1.4 k: Fairy tale
- Task 1.4 l: Participatory photography
- Task 1.4 m: Podcasts

Each of these tasks are described sequentially in the following sub-sections.

3.1 Book for kids “What’s Bioeconomy” (T1.4 a)

3.1.1 Introduction

Strengthening the knowledge and sensitivity of future generations to environmental issues, sustainability and circularity through information and education programmes targeting younger generation can contribute to raising future citizens, decision-makers and workforce, informed and interested in bioeconomy.

To tackle these challenges, the book "What's bioeconomy?" was developed in the frame of the European funded project BIOVOICES and it is the first book ever written for kids on the sustainable and circular bioeconomy. The authors of the book are Chiara Pocaterra (APRE) and Susanna Albertini (FVA) and the illustrator is Alistar Illustration[1]

The book targets kids from 5 to 8 years old, by presenting the bioeconomy and bio-based products from the “voice” of 2 kids and their big family in 5 everyday situations for kids (House, School, Countryside, Seaside, City - Supermarket – Park), 2 Transversal topics (Bioeconomy and Glossary) and a “Let’s play” section (to consolidate the knowledge gathered by playing). Each scene has an average of 10 flaps with information on bioeconomy issues and bio-based products as well as horizontal aspects (e.g., meaning of sustainability, circularity, climate change, etc.).

The book communicates scientifically sound contents in an easy and comprehensive way to European children, their parents and teachers in order to increase awareness of the environmental, social and economic benefits of the bioeconomy and its sectors, in particular bio-based sectors.

This book has been validated by a Scientific Committee involving 33 high level experts covering all the bioeconomy sectors, from academia and industry, representing several European countries.

[1] Alistar Illustration http://www.alistar.us/

The book for kids illustrates a story of a family (mum, dad, grandmother and four siblings) living in the world of the sustainable and circular bioeconomy, a world where everyone has a sustainable way of life, knows that waste is a treasure, where something new can come out from what is usually wasted. The book consists of eight scenes:

I. Five everyday scenarios: House, School, Countryside, Seaside and City - Park - Supermarket

II. Two transversal pages, to better understand some key elements of bioeconomy: Bioeconomy world and Glossary

III. One gaming page: Experiments and quizzes to consolidate the knowledge gathered by playing.

Each scene has an average of 10 flaps containing information about Bioeconomy bio-based products and horizontal aspects (e.g. meaning of sustainability, circularity, climate change).

The book is explained in the context of the webinars for teachers of the primary schools in order to support them in the use of the book during their lessons in the classroom. The webinars for teachers highlights how the bioeconomy can contribute in addressing the pressing environmental, societal and economic challenges, towards a more sustainable production, consumption and lifestyle: the various bioeconomy ecosystems like land and sea, but also production and transformation are covered, as well as impacts (e.g. new jobs, new educational pathways, careers, new way of living and valorizing what is actually considered waste). Multipliers are another target of interest.

3.1.2 Methodological approach

The book for kids “What’s Bioeconomy?” (BIOVOICES, 2021) is designed as a tool ready to be used by kids, but also by teachers and other multipliers to increase awareness of the environmental, social and economic benefits of the bioeconomy and its sectors, in particular bio-based sectors.

Chiara Pocaterra (APRE) conducted an analysis of what was already existing for teaching the bioeconomy for the children from 5 to 8 y.o and it turned out that the materials already available were not suitable for small kids and not really attractive. She prepared the first concept idea based on the way to communicate science for very young children developed, among others, by the Usborne Edition: book for kids from 5 to 8 y.o with flaps.

Chiara Pocaterra performed a web research to have a shortlist of three professionals in order to select the illustrator. A meeting with each illustrator was organised. The illustrator with more references and with a stylistic approach suitable to the work to be performed was selected: Alistar Illustration (Alistar, 2021). Alistar has been illustrating children’s books for over 10 years, working with different styles and media, both as an illustrator and an author. Her illustrations feature in books, magazines and advertisements. Alistar worked closely with the authors, stimulating a creative debate across many topics.

Chiara Pocaterra and Susanna Albertini (FVA) - the editorial team - defined the contents and realised the first sketches; the illustrator (Alistar Illustration) drew each scene following the instruction of the editorial team.

The editorial team contacted high level experts from all the bioeconomy sectors from institutional organisations, academia and industry from all over Europe in order to build a Scientific Committee. This Scientific Committee is formed of 33 members (BIOVOICES, 2021) and all of them have signed a letter of commitment confirming their consent to be part of the scientific committee for the validation of the book's content and images for the parts relating to their expertise, providing inputs and recommendations. They have also confirmed to treat confidentially any content received and to support the dissemination of the book for kids among their contacts.

The editorial team created the content through information coming from both research results of EU funded projects and scientific reviews and through a long-lasting experience on communicating the bioeconomy.

The content of the book was firstly validated for English proof-reading and common saying and then by the Scientific Committee in order to guarantee the quality of the content provided. All the versions before considered final were validated (English proof-reading).

APRE organized the launch event of the book for kids *What's Bioeconomy?* The official launch event took place online on 30th of March 2021, under the patronage of the European Parliament with an introductory video recorded by the President of the European Parliament MEP Roberta Metsola.

APRE, in the frame of GenB, has contacted experts for the translation of the four additional languages. APRE has identified new scientific contents to update some flaps of the book. As methodology, APRE contacts the researchers for discussing on how to present the information in a simple manner, collects the commitment letters from experts to be added in the scientific committee of the book, discusses the new drawings with the illustrator and fine tunes both the drawing and the description with the experts.

3.1.3 Developed materials

In the context of updating the book, the following actions have been mainly carried out:

1. Development of new content
2. Improvement of the scientific-technical content
3. Translation into four languages

Detailed information on each intervention is provided below.

Development of new content

APRE has identified new suitable contents for the book for kids. One content is based on the study developed by Dr. Irene Purasachit in her paper "Flaux - Flower Matter" that received a prize at the 2022 NEW EUROPEAN BAUHAUS initiative:

- https://2022.prizes.new-european-bauhaus.eu/it/application/flaux-flower-matter
- https://www.linkedin.com/feed/update/urn:li:activity:7033779456754204672/

APRE contacted the researcher to discuss about the content of the flap and the illustrator Allistar Illustration to define the new images to be added in the CITY scene and the related flap (Figure 2)

Figure 2. CITY scene of the book for kids. Image of the page on the left and image of the flap on the right

Both content and images were checked by the expert Dr. Irene Purasachit: she has signed the agreement to be part of the Scientific Committee of the book for kids.

The page with the list of the members of the Scientific Committee will be updated in the new version of the book before printing.

Improvement of the scientific-technical content

Some revisions of the translation of languages have emerged to be necessary: the Dutch version was completely revised by BTG and the Hungarian one is being revised by experts of the BIOEAST Initiative from Hungary and should be ready by June 2024.

Translation into four languages

The commitment in the DoA is the translation of the book into four languages (PL, FR, BG, SI). In addition, the new flaps will be translated into all the 16 languages and they will be available in the new version of the book. The new versions ready to be printed will be ready by the summer 2024.

Expected final outcomes

The new flaps will be both in the new printed versions of the book and in the online version.

LOBA will print around 5.500 copies in total distributed among 8 linguistic versions, the new languages (4) and other four languages (see section 3.1.4): the copies will be ready by December

2024 for the distribution in schools and during national and European events. Taking into account the budget available the copies that will be printed will be less than the expected, this is due by the high cost of paper, the increase of the printing costs and the transport costs for the quantity of book.

The online versions is available on the GenB website[2] and will be implemented by FVA by October 2024.

3.1.4 Languages versions

The book has been translated in 10 languages (Italian, Portuguese, Spanish, Greek, Dutch, German, Romanian, Slovak, Estonian and Hungarian) by the BIOVOICES partners and printed in 15.000 copies that has been distributed in selected schools, bookshops, museums for children and institutional contexts around Europe. The book was translated in French during the implementation of the Transition2Bio project (HORIZON 2020) and additional books were printed, reaching the 25.000 copies distributed. Thanks to that project the book was also digitalised, and it is still available at the link https://www.transition2bio.eu/games/

GenB has foreseen the translation of the book for kids in additional four languages: Polish, French, Bulgarian and Slovenian. APRE has translated the book in Polish, Maltese (instead of the French already available), Bulgarian and Ukrainian (instead of the Slovenian). LOBA has impaginated the new linguistic versions and has passed the files to the printing company.

3.1.5 Conclusions

The main deviation of this task is the translation of the book in Ukrainian instead of Slovenian. APRE has considered the importance to have the Ukrainian version in order to support the country in the implementation of the transition towards a climate neutral economy as declared by the President of the EC Von de Layen despite the war. The education of the new generation is a small piece of a bigger mosaic in the reconstruction of the country. APRE has foreseen 1.500 copies of the book for its distribution among the kids in Ukraine, printed by December 2024.

3.2 Role play card game “BioHeroes: Let’s save the planet!” (T1.4 b3)

3.2.1 Introduction

This role play card game is an immersive card game designed by AIJU to introduce children aged 4 years and older to the world of the bioeconomy. This game, which focuses on bioeconomy-related professions, aims to educate in a fun and practical way about the various professions found in this emerging field. The game not only aims to teach children what kinds of professions can arise in the bioeconomy, but also to familiarise them with the specific tasks they perform and how these relate to each other. It is a print to play game. Developed under the Game-based learning (GBL) methodology, the game is not only suitable for use in educational settings, such as classrooms by teachers, but can also be enjoyed in non-educational contexts, e.g. sharing time with the family, offering a playful and enriching learning experience for children of all ages.

[2] Visit https://www.genb-project.eu/resources/toolkits-for-pre-and-ealry-school/online-bioeconomy-book-for-kids--/

This game has been developed in the framework of Task 2.2 and refers to the commitment to develop a “role-play game on bioeconomy jobs at school”.

3.2.2 Methodological approach

Initially, professional profiles and their tasks were selected by conducting a literature search from secondary sources. The selection process considered the level of comprehension of the target audience for the game. Once selected, game design commenced. Simultaneously, scientific and technical validation of the content was conducted by partner BTG. Their contributions helped in refining the concepts and confirming that the chosen tasks accurately represent the professional profiles and are suitable for the target audience's understanding.

For game design, internal playtesting sessions were conducted (Figure 3) to iterate on mechanics, refine generated dynamics, and determine the number of cards, among other actions.

Figure 3. Internal playtesting session during the development of BioHeroes

Three experts from AIJU participated in the game design process, as shown in Table 2 of their expertise.

Expert	Name of the expert	Expertise
1	Ana Mata-Dominguez	Toy market analyst, User insights
2	Sonia Torres-Torres	Child development, Early childhood education, User insights
3	Clara Blasco-López	Design & Trend research, Toy design, User insights

Table 2. Experts participating in the BioHeroes: Let’s save the planet!" design

Concurrently, illustration design was coordinated with designer Manu Camacho from Agencia Magnet[3], design and communication studio with experience in the development of graphic content aimed at children. The definition of the graphic style began with the analysis of the book "What's Bioeconomy?" (see section 3.1), aiming to establish a visual coherence with the existing content. However, a thorough examination of the graphical elements in this book revealed a style deemed overly juvenile for the intended audience of the game, children aged 4 and older. Consequently, a decision was made to develop an entirely new graphical style, drawing

[3] Agencia Magnet https://agenciamagnet.es/

inspiration from "What's Bioeconomy?" while aiming for an aspirational appeal suitable for the target demographic. To maintain a visual connection between the two styles, emphasis was placed on utilizing the colour palette established in the book. Thus, it can be inferred that the graphic style adopted in the role-play card game "BioHeroes: Let's save the planet!" serves as a natural extension of the design principles set forth in "What's Bioeconomy?". Figure 4 shows the process of defining the graphic line of the card game "BioHeroes: Let's save the planet!"

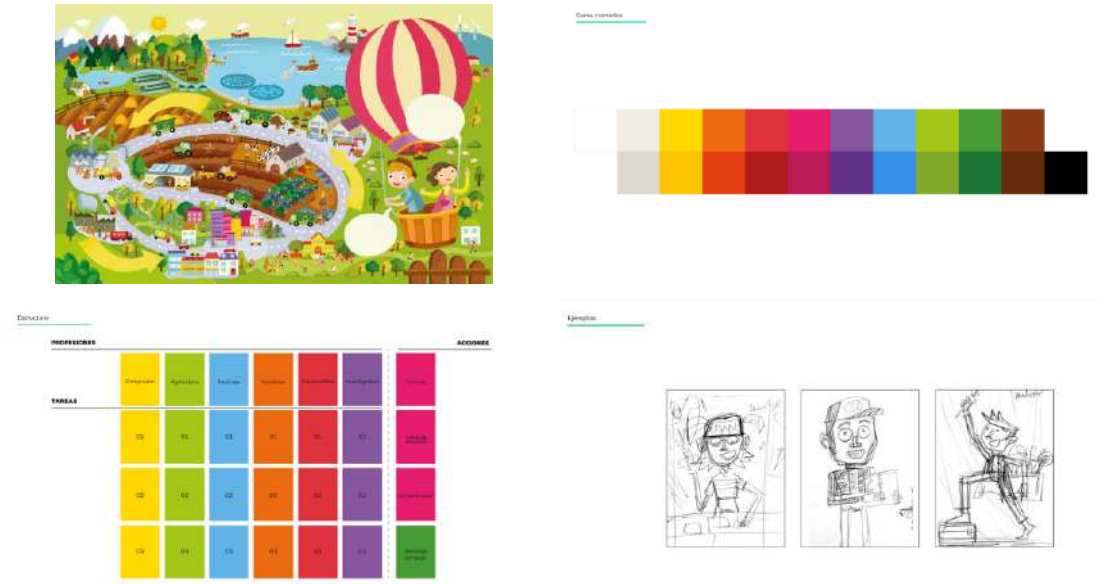


Figure 4. BioHeroes: Let's save the planet! graphic design process

With a preliminary version containing nearly final illustrations (pending minor adjustments), a playtesting session was conducted with children within the target audience. This test also helped enhance the gaming experience and ensure its suitability for the target audience.

The game was tested by partner EUN in gaming sessions organized with teachers and students, and by partner AIJU. EUN conducted a satisfaction survey at the end of the gaming session whereas AIJU collected the information both through observation and the bio-economic researcher's notebook.

While game testing was not a project objective, considering the interesting feedback received, it will be considered for a second session to improve and add more content. Incorporating suggestions from BTG during scientific and technical validation is also planned. This updated version is scheduled for presentation in December 2024.

3.2.3 Developed materials

The role play card game BioHeroes: Let's save the planet! starts with the following storytelling: Our world is under threat from imbalance: only the bioeconomy can save it! Fortunately, there are 6 bioeconomy professions that, if they manage to carry out all their tasks, can stop the destruction of the planet. The aim of the game is simple but crucial: be the first to help the bioeconomy professions fulfil their tasks and keep the Earth safe.

Figure 5. Bioeconomy professions, their tasks and action cards

Children find 6 different profiles related to the bioeconomy (Figure 5). To be more concise, there are five bioeconomy professions (5: Farmer growing bio-based materials, Recycling centre operator, Seller, Transporter and Bioeconomy researcher) and a role (1, the buyer) that corresponds to the figure of the consumer/user. It has been considered to include this figure instead of a profession because it is a role closer to the reality of the child playing the game. The tasks represented by each of them are shown in Table 3.

Profession	**Task 1**	**Task 2**	**Task 3**
Bioeconomy researcher	Develop creative products	Develop novel food	Conducting experiments
Farmer growing bio-based materials	Biological pest control with ladybirds	Rainwater harvesting	Use compost
Transporter	Design ecological routes	Select sustainable means of transport	Use sustainable packaging
Buyer	Enhance local consumption	Reduce, recycle and reuse	Enhance concious consumption
Seller	Offer bio-based, circular and recycled products	Offer local products	Offer products with ecological awareness labels
Recycling centre operator	Separating and sorting waste	Produce compost	Produce biogas

Table 3. Professions and their tasks

To add dynamism and fun to the game, action cards have been created (Table 4). Action cards can change the game to help participants win. Its use is focus on giving advantage or to prevent your opponents from completing their profession cards before you. Participants can play these cards as soon as they draw them from the deck or discard pile or choose to wait until it suits them.

Action card	Action
Tornado	When this card is played, all players pass their hand to the player on their right.
Lack of resources	The player can take a task card placed on a profession card by another player, as long as the profession card has not been completed.
Pollution	The player can choose another player of their choice to miss a turn.
Recycling	The player can discard their entire hand and draw 3 new cards from the draw deck.

Table 4. Action cards description

Although the core target audience for BioHeroes: Let's save the planet! is aimed at 4-8-year-olds, children aged 9 to 13 are also part of the game's target audience. To ensure suitability for this broad age range, two levels of difficulty are proposed. Each level includes a specific number of professions and action cards.

The game ends when all the profession cards face-up on the table are completed. The player who the most completed profession cards win. In the event of a tie, the player who first completed a profession card during the game is the winner.

Expected final outcomes

The update of the game has been planned with the incorporation of the feedback collected by EUN and AIJU. Once completed, it will be shared again with the partners.

3.2.4 Language versions

The game has been developed in English in the framework of Task 2.3, which does not require translations, so each partner will choose freely whether to translate the content based on the available resources. The material will be available on the GenB website.

3.2.5 Conclusions

In conclusion, the development of this role-play card game on professions in the bioeconomy has been an enriching process that has showcased the power of learning through play. The philosophy of "learning by playing" has been pivotal in creating a fun and effective educational experience for children. Furthermore, conducting satisfaction surveys and observations during gameplay sessions has allowed us to identify areas for improvement and fine-tune the game to maximize its impact and utility. This user-centric approach has provided us with the opportunity to tailor the game to the needs and preferences of our target audience, ensuring its relevance and effectiveness in both educational and non-educational settings.

3.3 Video teasers and educational videos (T1.4 d1)

3.3.1 Introduction

In order to target the age range from 4-8 years to raise awareness and educate in the bioeconomy the most effective way is through experiential learning. But videos with some specific characteristics are effective. Three types of resources have been developed to generate bioeconomy materials for the GenB toolkit through video teasers and educational videos:

1. Production of video teasers and educational videos specifically for the GenB toolkit.
2. Production of video teasers and educational videos in the framework of the GenB project during events held in partner countries, to be included in the GenB toolkit.
3. Selection of video materials produced by third parties, to be included in the GenB toolkit.

The video teasers and educational videos tool has been used to generate materials aimed at all three target age-groups of young people. Some videos target only one age group, others prove to be interesting for two or all three target age-groups. Appendix 2 gives an overview of the developed videos and their target group.

For the age group 4-8 years, two videos have been produced or are planned for production. In addition, two videos have been carefully selected from previous projects. These videos fall into three categories within the GenB project framework and are shown in Table 5. Information on each of them is provided in the next "Developed materials" section.

Type of the content	Name of the video	4-8 y.o.
Video teasers and educational videos specifically for the GenB toolkit	"What's Bioeconomy?" with GenB Ambassadors (educational video)	
	Video teaser 1: "Bio-based products" (with GenB Ambassadors)	X
	Video teaser 2: "Controversial Issues" (with GenB Ambassadors)	
Video teasers and educational videos in the framework of the GenB project during events held in partner countries, to be included in the GenB toolkit	Video reading "The Apple That Wanted to Travel" fairy tale	X
	TEDx pitches	
Video materials produced by third parties, to be included in the GenB toolkit	"What's Bioeconomy? Book for kids"	X
	"A Bio-based day"	
	"The Bioeconomy starts here"	X
	Videos about bio-based materials and products (video series)	
	Videos "Young Bioeconomy Entrepreneurs"	

Table 5. Video teasers and educational videos in the 4 to 8 y.o. target group

3.3.2 Methodological approach

An analysis of existing videos was performed by FVA partner, to identify what existing videos are available for this age range. These videos are reported in the next paragraph.

With regards to the production of new videos, the video teasers about bio-based products that the project will produce for the high school toolkit, are suitable for this age too, since they will be very visual and easy to be understood.

Finally, some videos have been (and will be) recorded during the country specific activities and will be made available for these countries.

3.3.3 Developed and selected materials

Video teasers and educational videos specifically for the GenB toolkit

Video teaser 1 "Bio-based products" (with GenB Ambassadors). GenB Ambassadors will showcase various biobased products and their corresponding feedstocks. Through informative subtitles, viewers will gain a deeper understanding of the diverse array of products derived from biobased feedstocks, illustrating the concrete outcomes of bioeconomy.

This is planned to be produced in the following months, specifically when the GenB Ambassadors will be trained in T3.2. The need to have the Bio-Based products physically in the hands of the GenB Ambassadors, force the project to organise the shooting involving only small groups of ambassadors located in the same country. To make sure that all the Ambassadors are somehow involved, new ideas and formats for self-recording are discussed. It should be taken into consideration that some Ambassadors have a basic knowledge of English language. FVA is designing a format enabling them to record the contents without speaking.

Video teasers and educational videos in the framework of the GenB project during events held in partner countries, to be included in the GenB toolkit

Video reading "The Apple That Wanted to Travel". A video with two young GenB Ambassadors reading the "The Apple That Wanted to Travel" was recorded during the European Researcher's Night in Italy (Figure 6). This video is available only in Italian, as an experimentation of a new format, which could be replicated by partners. Visit https://www.youtube.com/watch?v=SfCR1Of_h0Q&t=416s

Figure 6. Recording of the two young Italian GenB Ambassadors reading the Fairy Tale "The Apple That Wanted to Travel"

Video materials produced by third parties, to be included in the GenB toolkit

Regarding the selected video materials, here below the most suitable videos are listed, including a brief description.

What's Bioeconomy? Book for kids teaser. Kids present and give their feedback about the "What's Bioeconomy" book for kids. This video was produced by BIOVOICES project (Figure 7) and it is available on YouTube in the link https://www.youtube.com/watch?v=Jnt9nLEu3mM&t=79s

Figure 7. Screenshot of What's Bioeconomy? teaser

The bioeconomy starts here. This video has been produced by the European Commission, which launched the following description: *"You may have heard of the bioeconomy and wondered what it is all about. It describes a future in which we rely on renewable biological resources to meet our needs for food, materials and energy. At the European Commission, we believe this future is very near. And we have launched a strategy about working with nature for a more sustainable way of living. The bioeconomy starts here.... Be part of it!"* (Figure 8) The video is available on YouTube in the link https://www.youtube.com/watch?v=2xvXkOMRTs4

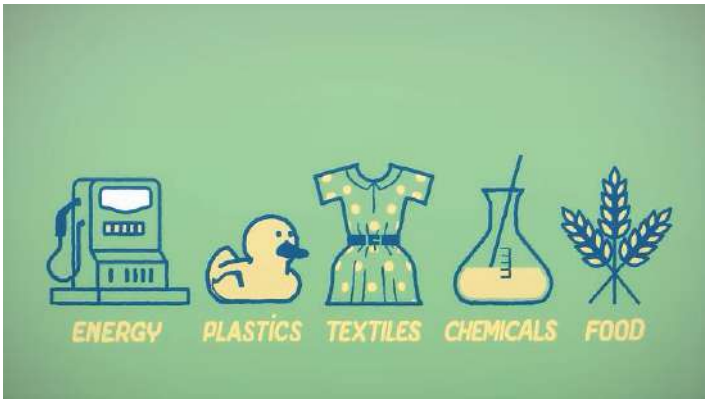


Figure 8. "The bioeconomy starts here" video screenshot

Expected final outcomes

The videos will be added to the final version of the toolkits.

3.3.4 Language versions

It is expected that not all the videos collected through this process will be multilingual, but they will be in the language of the country where they are produced, and it doesn't make sense to

add subtitles since the target audience is very young kids. The 9 language versions will be available on the GenB website at https://www.genb-project.eu/ by December 2024.

3.3.5 Conclusions

The use of video teasers and educational videos is an effective tool to educate and raise awareness of bioeconomy issues among young target audiences. These audio visual formats capture attention and are aligned with the digital content consumption trends of the target audience. This is why they offer the opportunity to transmit complex information in a motivating, accessible and attractive way. Moreover, by being easily shareable on digital platforms, these videos can amplify their impact and reach a global audience, thus contributing to building a sustainable and conscious future.

3.4 Hands-on experiments (T1.4 j)

3.4.1 Introduction

Hands-on experiments are a format used in GenB where young people are actively engaged in experiments with the aim to discover many uses for bio-waste and see how they can be transformed into products. The hands-on experiments are targeted to young people of different age groups. The core target group of this material is children aged 6-13 years. Therefore, it is considered appropriate for it to be a material that forms part of both the pre and elementary toolkits.

This material can be used in formal, non-formal and informal education settings. The aim to communicate knowledge of the bioeconomy and bio-based solutions in an easy, experiential and comprehensive way (for more information on the format see D2.2).

In addition to the use of 10 experiments developed in Trasition2Bio, GenB partners have developed new experiments during the project implementation with students.

3.4.2 Methodological approach

The three experiments were tested in the context of hands-on activities with three classrooms of the I.C Guicciardini school (Rome) between march and May 2023, two of which are primary classes (age 8-9 y.o.) and one is an elementary school class (11 y.o.). In addition, in June 2023, the experiments have been tested in the context of an open-air large-scale event with an afterschool project in Rome. A total of 100 students were involved in these testing activities.

3.4.3 Developed materials

Three new hands-on experiments have been piloted and developed by APRE and transformed into ready and easy to use educational factsheets for teachers and multipliers. The hands-on experiments have been designed in two formats: for print and for web use.

Experiment No. 1: Use fruits, vegetables, and spices creatively: make beautiful watercolors!

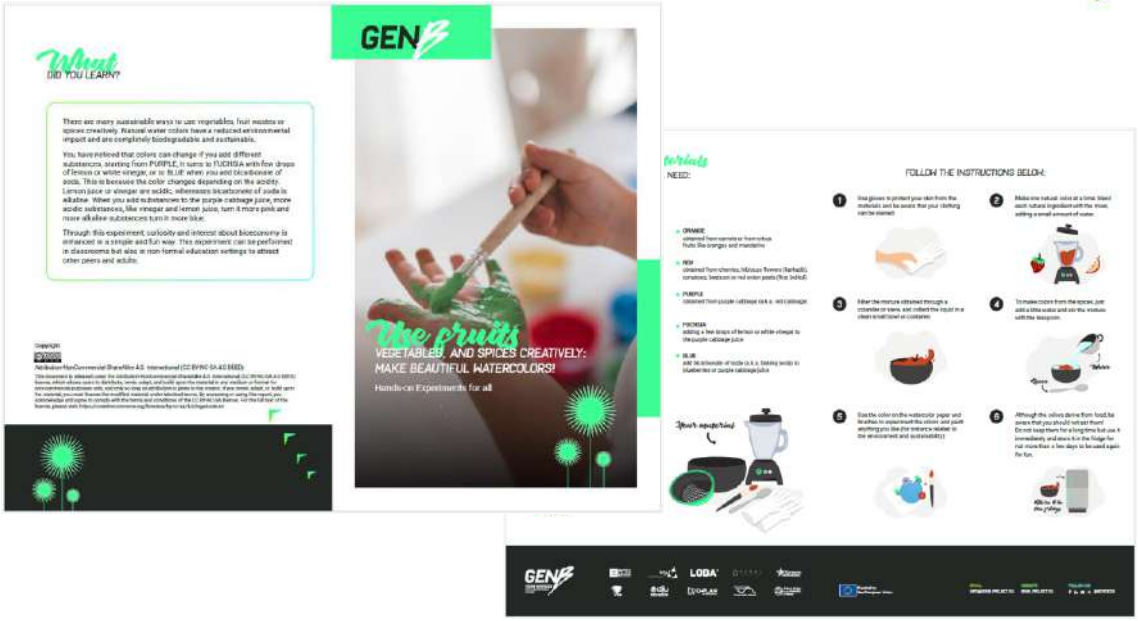


Figure 9. New Hands – on experiment N.1. Layout web version

There are many sustainable ways to use vegetables, fruit waste or spices creatively. Through this experiment, young people learn that there are many sustainable ways to use vegetables, fruit waste or spices creatively. Natural watercolors have a reduced environmental impact and are completely biodegradable and sustainable (Figure 9). For this experiment you will need the materials described below.

Ingredients:

- GREEN: obtained from parsley, or spinach (boiled first)
- BROWN: obtained from coffee, barley, bitter cocoa, tea, or cinnamon
- BLACK: obtained from vegetal charcoal or black sesame seeds
- WHITE: obtained from finely grated coconut flour or icing sugar
- YELLOW: obtained from turmeric and curry, but also from pepper and yellow onion peels (first boiled)
- ORANGE: obtained from carrots or from citrus fruits like oranges and mandarins
- RED: obtained from cherries, hibiscus flowers (karkadè), tomatoes, beetroot or red onion peels (first boiled)
- PURPLE: obtained from purple cabbage (a.k.a. red cabbage)
- FUCHSIA: adding a few drops of lemon or white vinegar to the purple cabbage juice.
- BLUE: add bicarbonate of soda (a.k.a. baking soda) to blueberries or purple cabbage juice

Materials:

- Watercolor paper
- Brushes

- mixer
- small bowls or containers
- teaspoon
- colander or sieve
- Gloves

Follow the instructions below:

1. Use gloves to protect your skin from the materials and be aware that your clothing can be stained.
2. Make one natural color at a time: blend each natural ingredient with the mixer, adding a small amount of water.
3. Filter the mixture obtained through a colander or sieve and collect the liquid in a clean small bowl or container.
4. To make colors from the spices, just add a little water and stir the mixture with the teaspoon
5. Use the color on the watercolor paper and brushes to experiment the colors and paint anything you like (for instance related to the environment and sustainability)

Although the colors derive from food, be aware that you should not eat them! Do not keep them for a long time but use them immediately and store them in the fridge for not more than a few days to be used again for fun.

Experiment No. 2: Try to produce your own bio-based plastic from corn starch!

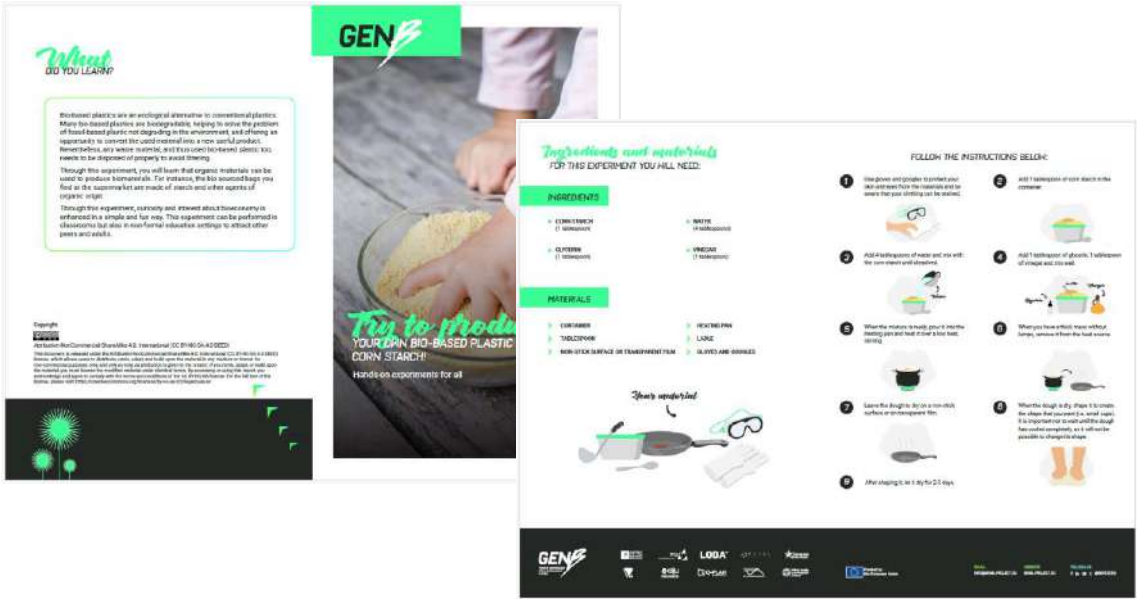


Figure 10. New Hands – on experiment N.2. Layout web version

Through this experiment, young people learn that organic materials can be used to produce biomaterials. For instance, the bio sourced bags you find at the supermarket are made of starch

and other agents of organic origin. For this experiment (Figure 10) you will need the materials described below.

Ingredients:

- Corn starch (1 tablespoon)
- Water (4 tablespoons)
- Glycerin (1 tablespoon)
- Vinegar (1 tablespoon)
- Materials:
- Container
- Tablespoon
- (Non-stick surface or) Transparent film
- Heating pan
- Ladle
- Gloves and googles

Follow the instructions below:

1. Use gloves and googles to protect your skin and eyes from the materials and be aware that your clothing can be stained.
2. Add 1 tablespoon of corn starch to the container.
3. Add 4 tablespoons of water and mix with the corn starch until dissolved.
4. Add 1 tablespoon of glycerin, 1 tablespoon of vinegar and mix well.
5. With the mixture is ready, pour it into the heating pan and heat it over a low heat, stirring.
6. When you have a thick mass without lumps, remove it from the heat source.
7. Leave the dough to dry on a non-stick surface or on transparent film.
8. When the dough is dry, shape it to create the shape that you want (i.e. small cups). It is important not to wait until the dough has cooled completely, as it will not be possible to change its shape.
9. After shaping it, let it dry for 2-3 days

Experiment No. 3: Make homemade natural toothpaste!

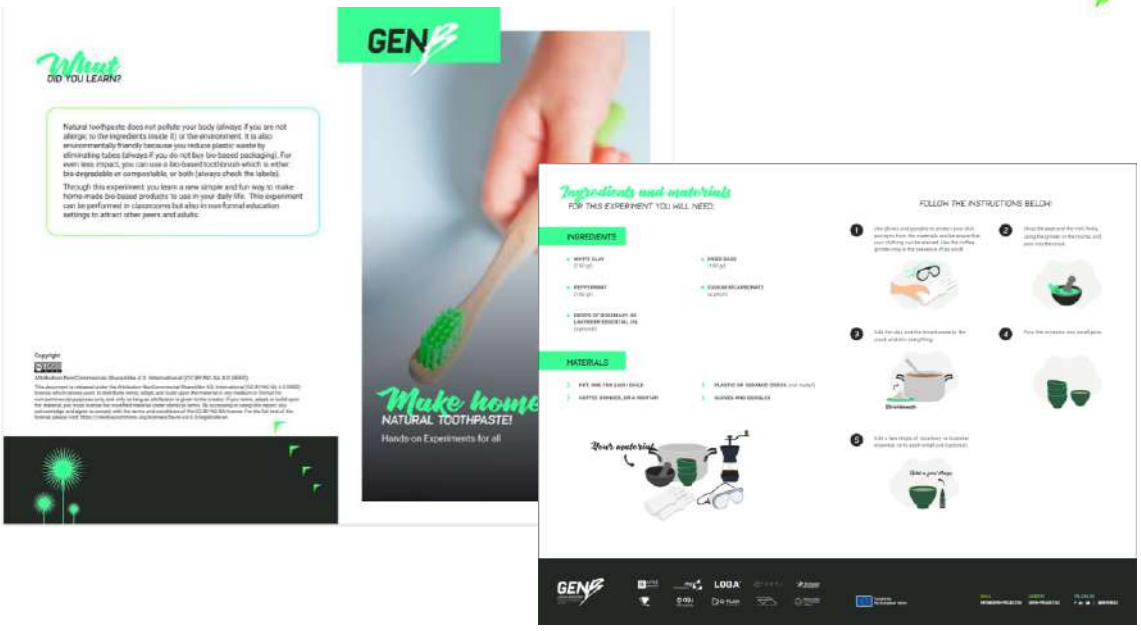


Figure 11. New Hands – on experiment N.3. Layout web version

Through this experiment (Figure 11), young people learn to make natural toothpaste to be used in their daily life. Natural toothpaste does not pollute the environment and is also environmentally friendly because you reduce plastic waste by eliminating tubes. For this experiment you will need the materials described below.

Ingredients:

- White clay (150 g.)
- Dried sage (100 gr)
- Peppermint (100 g.)
- Sodium bicarbonate (a pinch)
- Drops of rosemary or lavender essential oil (optional)

Materials:

- Pot, one for each child
- Coffee grinder, or a mortar
- Plastic or ceramic crock (not metal!)
- Gloves and googles

Follow the instructions below:

1. Use gloves and googles to protect your skin and eyes from the materials and be aware that your clothing can be stained. Use the coffee grinder only in the presence of an adult
2. Chop the sage and the mint finely, using the grinder or the mortar, and poor into the crock
3. Add the clay and the bicarbonate to the crock and mix everything.

4. Pour the mixtures into small pots
5. Add a few drops of rosemary or lavender essential oil to each small pot (optional)

The factsheets are protected by APRE's copyright.

3.4.4 Language versions

The experiments are available in English language and in Italian and the English version[4] is hosted in the GenB website. Given these are additional to the toolkits foreseen in the DoA, partners can translate them in their local language to be used in their local contexts, but this is not a mandatory requirement.

3.4.5 Conclusions

The factsheets with the new developed experiments will be available in all languages in the GenB toolkit and represent a valuable educational tool to be used by teachers, parents and multipliers with different age groups (from 6 to 13 y.o.). The piloting of the three experiments in the context of GenB hands-on labs in Italy has been very valuable. The water colour experiment, especially, attracted a lot of interest and excitement from all age students as well as their teachers and families.

3.5 Fairy Tale (T1.4 k)

3.5.1 Introduction

Fairy Tales is a tale aimed at children from 4 years of age, which aims to introduce the concepts of bioeconomy through storytelling. Storytelling is the most natural way to stimulate the curiosity and elicit learning in very young kids. During the interactions with teachers in GenB and previous projects, the need to have simple, but inspirational stories emerged and, in response to this request, APRE and FVA developed a new format, the Fairy Tale on bioeconomy topics. This format can be used in several ways, namely:

1. Be read by the teachers or multipliers during educational activities on the bioeconomy
2. Be read/acted by the youngest GenB Ambassadors in the context of large-scale events, targeting kids (e.g. The European Researchers' Night)
3. Become the text for a book (although no dedicated budget is foreseen, therefore alternative funding sources or collaboration with publishers are under exploration)

A first Fairy Tale was produced, together with some cartoonish images, to be tested during the European Researcher's Night 2023 in Rome, Italy. It should be noted that this task is not foreseen in the GenB DoA, therefore it should be considered a preliminary exercise to validate a promising format.

[4] Visit https://www.genb-project.eu/imagem/CornStarch_Brochure.pdf, https://www.genb-project.eu/imagem/UseFruits_Brochure.pdf and https://www.genb-project.eu/imagem/Toothpaste_Brochure.pdf

3.5.2 Methodological approach

To explore the possibility to create Fairy Tales to promote the bioeconomy took place through the following steps:

1. Analysis of similar formats (existing books and stories).
2. Selection of few bioeconomy topics that can be the inspiration of a Fairy Tale
3. Creation of the first example
4. Identification of possible sources for new stories
5. Testing of the first Fairy Tale
6. Translations

Analysis of similar formats (existing books and stories).

The first step to develop this format was the analysis of similar formats developed by third parties. This was done through desk research and by speaking with publishers at a big book fair in Italy. The outcome of this exercise was that, despite there are several books in form of stories on sustainability, recycling, sustainable lifestyle and protection of the nature, widely available books for kind on the bioeconomy are very rare. An example are the books produced by the "Fondazione Raoul Gardini"[5], written by Gunther Paoli, but they target a higher education level. Other interesting examples in sustainability topics are the books written and produced by Nicoletta Costa[6]. APRE and FVA, as part of this analysis contacted the two examples mentioned, as well as several publishers.

Selection of few bioeconomy topics that can be the inspiration of a Fairy Tale

In parallel, a selection of potential topics to be developed, as well a discussion about the format and style to be used, was done by FVA and APRE. The initial idea was:

- Use a simple, but inspirational storytelling style.
- Highlight the value of the bioeconomy for a sustainable living preserving the resources for the future generations.
- Highlight the role that everybody can have, from kids to researchers.
- The waste can become a resource. The waste can be the main character of the story.
- Use objects or feedstock from everyday life, well known by the kids.
- Keep a positive style and a message of hope.

As for the subjects, the apple, algae and manure have been identified as more suitable for the target age. The apple was selected for the first story.

Creation of the first example

The first story "The Apple That Wanted to Travel" was created in Italian by Susanna Albertini from FVA and validated by FVA and APRE people.

[5] Le favole di Gunter Pauli diventano Darsena in blu, progetto di educazione alla crescita sostenibile, presente nella Green Community del MIM - Fondazione Raul Gardini

[6] Il Blog Ufficiale di Nicoletta Costa – Autrice di libri per bambini con personaggi quali Nuvola Olga, Giulio Coniglio, Signor Aquilone, Strega Teodora, i Gatti e molti altri.

Identification of possible sources for new stories

Further sources or collaborations for the development of additional stories have been explored. Specifically, some GenB Ambassadors, from a school specialized in communication, have been requested by APRE to create other stories. The result of this call was not very satisfactory, since the students were not yet empowered with the GenB Capacity Building and maybe the storytelling is not a skill they have. In parallel APRE contacted Nicoletta Costa to have a quotation for the creation of new stories.

Testing of the first Fairy Tale

The first Fairy Tale "The Apple That Wanted to Travel" was tested with some kids and concept was validated by other GenB partners. The kids enthusiastically welcome APRE's proposal to read the story during the European Researchers' Night in September 2023. This reading took place as part of the "Students2Students" activity (see D 3.2 for the full description), after some preparation that was undertaken by APRE (Figure 12).

Figure 12. Two young GenB Ambassadors ready the Fairy Tale "The Apple That Wanted to Travel", in the context of the European Researchers' Night – Rome, Italy

Translations

The Fairy tale was translated in English by APRE, to be made available to the partners for translations in their languages. It should be noted that, being an unforeseen format, the translation in all partners' languages is non-mandatory.

3.5.3 Developed materials

The first Fairy Tale "The Apple That Wanted to Travel" was developed by FVA in collaboration with APRE. The writing of the story and the production of illustrative images were carried out.

Fairy tales' text

Here is the text of the Fairy Tale:

"The Apple That Wanted to Travel"

A long time ago, in a peaceful orchard in the green hills of Trentino, a little apple named Melania was born. From a young age, she had a dream, a wish that made her feel different from all the other apples: she wanted to travel and see the world.

The other apples laughed at her when she talked about faraway and wonderful places she would visit. "Melania, you're silly!" they said. "We are apples! Our job is to become tasty snacks, delicious cakes, healthy juices, or yummy jams. You can't just ripen like the rest of us!"

But Melania didn't agree and kept to herself, daydreaming while the other apples enjoyed the warm summer sun.

The day of the harvest came, and the apples were placed in a fragrant pile on a spruce wood counter to be sold. Melania was bought by a family in Rome and enjoyed the long journey while looking out of the window. They passed through Bologna, the Apennines, Florence, and finally arrived in the capital!

The next day, there was a festive atmosphere, and Melania's new owner, the mom, took her in hand and asked, "Do you want to become the star of Andrea's birthday cake?" Melania hopped with joy; she liked the idea of her pulp becoming a fragrant cake to celebrate the child's 5th birthday. It was a wonderful party, and everyone praised the sweet treat!

During the party, Andrea's two sisters, Francesca and Chiara, took the apple seeds and ran to plant them in the garden: "You will become a beautiful tree that will give us delicious apples every year to remember our vacation in Trentino!"

Meanwhile, the mom set aside both the core and the peel of the apple to be collected with the organic waste. "Stop!" said the children's father. "The peel is for me!"

While the core, collected in the organic waste, became compost in a few months and was used to fertilize the soil and support the growth of the apple sapling, the peel was taken by the father, who had a secret plan in mind. He was a technology and sustainability enthusiast and had been studying bioeconomics, transforming waste into resources.

In his laboratory, he asked Melania, "Do you want to become apple leather, an ecological fabric used for shoes, sofas, handbags?" "Yes!" she answered enthusiastically, imagining a new and exciting adventure.

And that's how Melania truly began to travel! The apple leather was used by a craftswoman to create a magnificent backpack, which was bought by a globe-trotting girl, Claudia. Together, they visited all of Europe, the United States, and even the Amazon rainforest! The girl was very proud of her eco-friendly backpack, and everyone complimented its softness and durability.

After a few years, Claudia decided to visit Trentino and stopped in the same valley where the apple had grown. Melania couldn't contain her excitement! She would meet the tree she had grown on again and tell everyone about her adventures around the world!

And so, while Claudia was asleep reading a book in the shade of the big tree, Melania recounted her travels to the other apples, who began to sway on the branches, shouting, "Long live circular bioeconomics! We also want to become new products and travel the world!"

Melania continued to travel far and wide with Claudia. Wherever they went, the apple leather backpack attracted attention and awe. It was more than just an accessory; it was a symbol of courage and determination.

Melania's story teaches us an important lesson: dreams have no limits, and if you truly believe in them, you can make them come true. Living sustainably is possible, and even waste can be transformed into valuable resources, helping to reduce waste and preserve our planet.

To date, the result is protected by copyright and the Partners are evaluating the possibility to further protect the idea through other Intellectual Propriety Rights (IPR).

Fairy tales' illustration

To complement the Fairy Tale, in particular the public reading, a graphical package was prepared by FVA, with images to be projected during key moments of the story (Figure 13) and the fully developed visuals are available in Appendix 3.

Figure 13. Some of the images created to complement the Fairy Tale

The possibility to create an animated cartoon was explored by LOBA, but the cost is too high and there is no budget foreseen for that.

3.5.4 Language versions

The Fairy Tale "The Apple That Wanted to Travel" is available in English and Italian. They will be made available as part of the GenB Toolkit to be shared on GenB website in the future months.

3.5.5 Conclusions

This activity was not foreseen in the DoA but was developed by the Italian partners to respond to the needs expressed by several teachers during capacity building and other activities. The public appreciated the fairy tale and the way it was delivered through the little GenB Ambassadors reading in the context of the EU Researchers' Night in Rome.

After the first Fairy Tale, FVA and APRE are exploring the possibility to create new stories, with different subjects.

A first presentation of the idea to several publisher in the context of a big bookfair collected enthusiastic comments. Further collaborations will be explored to expand the impact of this activity beyond the GenB objectives.

3.6 Participatory photography (T1.4 l)

3.6.1 Introduction

Photography, as other art form in educational contexts can be useful to bring out moments of reflection, insight and awareness, inspiring real social change and being able to make different consumption and life choices as well.

Participatory photography can be used to engage youth and families on the opportunities of circular bioeconomy in their everyday context. Through photographs (and/or video recordings), young people 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, through this format, young people (primary education classes) take photographs together with their families, who are actively involved as key players in lifelong learning. Older children (middle and high school) can take photographs and videos by themselves.

3.6.2 Methodological approach

In the GenB Living lab (2023) organized by APRE, participatory photography was used in the primary class of I.C Guicciardini Roma as a homework activity suggested to the teacher in order to deepen the bioeconomy concepts learnt in the classrooms.

3.6.3 Developed materials

The format developed by APRE has been transformed into an educational factsheet to be used by teachers and by students themselves. The factsheet is protected by APRE's copyright.

Description:

Teachers can assign students a homework assignment: take photos (and/or videos) in which there are represented:

- examples of biomass they find at home and/or in the neighbourhood;
- places in the neighbourhood where biomass is produced from waste (e.g., market, florist, etc.);
- representations of virtuous actions in reusing some of this waste, either at home or in the neighbourhood.

If videos are used, the parents/kids themselves (depending on the age target) can record small videos in which the young people explain some of the concepts learned in the classroom (e.g., circular bioeconomy, example of biomass, recycling etc.).

Teachers can collect the photos and videos and watch them all together in the next meeting during classroom hours. During the collective discussion, they can understand if the local community is representative of many virtuous examples and what other examples can be found.

Parents who have social media can post photos and videos by writing, "We can create a more #resilient city through #bioeconomy" and can tag the project by adding @BIOVOICES. GenB's social media can be found on the @biovoices channel on Instagram, Facebook, LinkedIn, and YouTube.

To engage the entire school community, photo competitions can be held in which the students, who find the most bio-based products and the most representative examples, are awarded.

The photographs and videos can be displayed in a final exhibition. In this case, the workshop participants become promoters of a shared instance that is expressed in a final exhibition that takes place in the relevant context in which the workshop took place.

In the GenB Living lab 2023 organized by APRE, this format was used in the primary class of I.C Guicciardini Roma. The children and teachers really enjoyed the format as they had fun unearthing natural bioeconomy products in their neighbourhood.

3.6.4 Language versions

The material is available in English and in Italian and will be available on the GenB website (GenB Library section and Resources section). Given these are additional to the toolkits foreseen in the DoA, partners can translate them in their local language to be used in their local contexts, but this is not a mandatory requirement.

3.6.5 Conclusions

The factsheets with the new developed format will be available in the GenB toolkits and represent a valuable educational tool to be used by teachers as homework activity with different age groups (from 6 to 13 y.o.), and by parents. During the piloting of the format at the I.C. Guicciardini School in Rome by APRE, the children and teachers really enjoyed the activity as they had fun unearthing natural bioeconomy products in the neighbourhood.

3.7 Podcasts (T1.4 m)

3.7.1 Introduction

The market of digital tools from the creative industry is growing and is expanding possibilities also for very young children that are more prone to the use new digital formats, such as podcasts.

APRE has decided to produce podcasts for children from 4 to 8 years old, their parents and multipliers because podcasts provide a brilliant way of realising information and they can be played in the car, before bed to wind down or while the parents are cooking, doing jigsaws or colouring. Podcasts help children to focus and encourage their imaginations to expand. APRE also loves that the best podcasts for children are so artfully produced, meaning parents will enjoy them too, and listening can be a family activity.

Podcasts manage to combine learning with fun teaching children (and often adults) something new, in an accessible, entertaining way.

For this reason, APRE will produce a podcast for kids focused on fairy tales that will compose an interesting and coherent story to promote the principles of bioeconomy, involving young children and youth to act and become promoters of more sustainable lifestyles.

3.7.2 Methodological approach

The first series of the podcast will consist of 10 episodes/fairy tales written by famous authors. The authors have been selected based on the quality of their publications (verified by the number of copies sold and reader reviews), as well as their social following, which identifies them as excellent promoters of the project. The first episode will serve as an introduction and the last one as a conclusion to the continuous story that the entire series will build. The 8 central episodes will be more specific and set in different locations based on the biomass featured/mentioned in the stories. After this first series of fairy tales, the podcast channel will be populated with fairy tales written by anyone willing to participate in the podcast project. Each fairy tale will be validated by scientific and pedagogical experts before publication. The editor (APRE) will assure the consistency of the editorial style within the overall product.

3.7.3 Developed materials

Contacts with authors have been initiated and first structure of the fairy tale series has been agreed. Once the result will be ready, APRE will identify the more pertinent IPRs.

3.7.4 Language versions

The podcast series will be produced in Italian and English, with the possibility of being translated into the languages of the GenB partners upon their availability and published on the GenB website.

3.7.5 Conclusions

The podcast aims to provide a tool for parents and educators to introduce the basic principles of bioeconomy. Learning this content through fairy tales is effective because children are predisposed to listening and their curiosity is stimulated by the narrative structure. The idea of continuing the podcast through the collection of fairy tales written by anyone who wants to participate serves to make people feel part of the project, and therefore captivates and informs a wider target audience beyond the primary target of the podcast. The podcast serves as an introduction to a broader range of tools, designed for other age groups and learning abilities, that will further explore the introduced concepts.

4 Toolkits for Elementary school (9-13 y.o.)

The toolkit for young people in Elementary school consists of a total of three materials. They are identified in Task 1.4 as follows:

- Task 1.4 b1: Educational board game
- Task 1.4 b3: Role play card game “BioHeroes: Let’s save the planet!”
- Task 1.4 d: Video teasers and educational videos for 9-13 y.o.
- Task 1.4 j: Hands-on experiments
- Task 1.4 l: Participatory photography

Each of these tasks are described sequentially in the following sub-sections.

4.1 Educational board game (T1.4 b1)

4.1.1 Introduction

The educational board game [the name is still under validation] represents a gamified educational tool designed to be part of the toolkit aimed at students in the elementary school aged 9-13, although the game is suitable for ages 8 and upwards. The game can be used in classroom but also in non-formal education settings to involve and engage other peers and adults.

The objective of the game is to obtain the highest number of Sustainability Points. To do this, players must manufacture bio-based products. Each Bio-based Product has its own formula, and each formula requires a number of waste products (Biomass) and a number of Energy units. The purpose of this material is to increase the awareness and knowledge of the sustainable and circular bioeconomy and its applications, exploring the processes related to the production of bio-based products.

The educational board game is being developed in Task 1.4 as a follow-up to the conceptual game created in Task 1.3 Co-creation of the awareness, information and education innovative approaches by APRE during GenB living lab in Italy. Capitalizing on this outcome and AIJU's commitment to develop a "game or gamified educational experience for Elementary school” (referred to as subtask 1.4b in the current deliverable), APRE has decided to concentrate their efforts on advancing the game's development to achieve a functional prototype and explore potential production and IPR options, rather than initiating a new game development process. As AIJU has experience in consultancy and development of games aimed at children as educational materials in both formal and informal play environments, there is a great opportunity to finetune and validate together quality content to design the game.

Consequently, within the scope of Task 1.4, the detail phase (phase 2) has started, running concurrently with the development phase (phase 3), facilitated by the collaboration between APRE and AIJU. More details about the progressing phases of the game are reported in the Methodology approach sub-section.

Regarding the results obtained, this deliverable includes a detailed description of the tasks already performed, the description of the game's objectives, a general overview of its mechanics, and an outline for future developments that will follow the presentation of this deliverable.

By June 2024 the first prototype of the result will be ready. In addition, APRE is working with a team of legal consultants to register a trademarking on the game name and ensure the exploitation of the product.

The final version will be available in the second version of the GenB toolkits (December 2024). However, a first draft (wireframe) is available on which the validation processes have been carried out and is presented in the following sections.

4.1.2 Methodological approach

In the context of the GenB living lab in Italy (conducted under the Task.1.3 Co-creation of the awareness, information and education innovative approaches), APRE has developed a board game which aims to increase youngsters' awareness on the sustainable and circular bioeconomy and bio-based products. The recipients are elementary school students (9 -13 years old) and their parents, teachers and other adults who will play together with them. The game has been co-designed and prototyped with students of two Elementary classes (Rome, Italy) throughout four living lab workshops (March 2023 – May 2023). The prototype was further played and tested in an open school event ("Sustainability Day", May 2023) involving parents and external stakeholders where students took on the role of "experts". On that occasion a short questionnaire was distributed to parents to collect feedback on the game. For more detailed information, please refer to D1.2 Report on co-design activities.

In September 2023, APRE organised a Focus Group involving around 16 experts (scientists, teachers, educationalists, and science communicators) to test the bioeconomy game, collecting feedback through surveys and focus group discussion. Divided in three groups, the experts played the game, with APRE staff facilitating the dynamic, and then answered to the survey in a written form assessing the games functionalities and contents. In addition, in a common discussion, they shared their reflections with us, and reflected on the game's strengths and weaknesses, providing their suggestions for improvement and for exploitation (**Errore. L'origine riferimento non è stata trovata.**). Based on the insights obtained from the Focus Group, the content was further refined and then subjected to a third validation step involving new APRE staff members, and 3 additional external professionals (from industrial and research sector with expertise on the green and blue bioeconomy).

Figure 14. Expert validation during a Focus group

The refinement, second round of validation of the game contents and processes have been carried on by APRE in collaboration with AIJU.

The development of the board game is structured into three phases and sub phases:

1. Conceptual phase
   1.1. Co-creation Phase
   1.2. Exploration Phase
   1.3. Experimentation Phase
   1.4. Evaluation Phase
2. Detail phase
3. Development phase

Phases 1 and 2 are correlative.

In the *1. Conceptual phase*, a co-design and validation process with students and experts has been carried out. This phase is fully completed as it is linked to the results obtained in task 1.3. In the *2. Detail phase*, the game has been developed in detail, iterating after the implementation of results from validations with children and experts. This phase is carried out under task 1.4 and it is partially completed, as the game development so far has been shared internally between APRE and AIJU. In the *3. Development phase*, work on the functional prototype, production analysis and legal terms is ongoing and is expected to be completed by June 2024. Each phase and sub phase will now be described in detail:

Phase 1. Conceptual phase

It refers to a co-design and validation process with students and experts task. From March 2023 to May 2023 APRE conducted a Living Lab process in 2 classes of a primary and lower secondary school (Rome), through 4 co-creation workshops (co-ideation, exploration, experimentation, evaluation). In September 2023, a focus group with experts was also conducted as part of the

evaluation phase. For more detailed information, please refer to D1.2 Report on co-design activities.

Phase 2. Detail phase

Phase 2 begins within the framework of task 1.4. AIJU has experience in consultancy and development of games aimed at children as educational materials in both formal and informal play environments whereas APRE has the knowledge and contacts to ensure that the scientific-technical content is aligned with the scope of the game.

The refinement process has been a shared exercise between both partners. Their contribution focuses on the following aspects of board game design:

- Revision of the mechanics and dynamics of the game into a unique and attractive proposal for the target audience. (APRE-AIJU)
- Development of clear game instructions appropriate to the vocabulary of the target audience, together with attractive naming proposals for the elements of the board game (APRE).
- Revision of clear game instructions appropriate to the vocabulary of the target audience, together with attractive naming proposals for the elements of the board game (AIJU).
- Conceptual design of the board game elements (board, tokens, cards) and their layout during the game (APRE).
- Revision of the design of the board game elements (board, tokens, cards) and their layout during the game (AIJU).
- First study of the suitability of the game for the target group (boys and girls between 9 and 13 years of age) (APRE).

Moreover, APRE has been in charge of ensuring that the scientific-technical content is aligned with the theme, is of high quality, and is suitable for the game's target audience. To achieve this, it has relied on the participation of 16 external experts coming from different fields (including researchers on the bioeconomy, chemistry and biology, pedagogy and game experts, industry representatives, as well as teachers), new APRE staff members, and 3 additional external professionals (from industrial and research sector with expertise on the green and blue bioeconomy). In April 2024, APRE have held a co-design session to present attractive proposals for the name of the board game.

Phase 3. Development phase

Phase 3 develops in parallel to phase 2. Its development is focused on the design of the game and the management of legal advice. It is structured into the following phases and sub phases:

3.1. Design of the game
  3.1.1. Design of the final elements of the game (board, tokens, cards)
  3.1.2. Preparation of the final arts for print to play version and printing version
  3.1.3. Search for suppliers
  3.1.4.Construction of a functional prototype.
  3.1.5. Launch of a Social Media post to collect feedback on potential name of the board game

3.2. Management of legal advice, leading to the patent of the developed product
3.3. Study of the suitability of the game
  3.3.1.for the target group (boys and girls between 9 and 13 years of age).
  3.3.2. through experts in child development, game design and toy market.
3.4. Calculation of number of elements (tokens, cards) for a good game dynamic.

APRE is working with a team of legal consultants to register a trademarking on the game and ensure the identification of the result as Key Exploitable Result of the project.

4.1.3 Developed materials

Instructions, game details and game components

The instructions, board and all elements of the game have been developed as stated in the Phase 2. Detail phase. The Educational board game is designed for young people and aimed at increasing their awareness and knowledge of the sustainable and circular bioeconomy and its applications, exploring the processes related to the production of bio-based products. Figures and more details about the developed materials will be shared after the finalisation of the legal protection process.

Expected final outcomes

The educational board game is a first prototype, with the idea that it can be disseminated to pre-school & early-school students (4-8 y.o.), elementary school students (9-13 y.o.), teachers, multipliers and non-formal educators (museums, festivals, NGOs, …),parents (collaborative use with teachers and educators) and other R&I projects and their consortia that deal with young people to learn the bioeconomy through an educational tool.

The game has undergone numerous validation and refinement processes to meet the expected educational objective and target group. It will be continuously validated by experts (scientific, education and legal experts). The production and distribution of the board game will be also assessed. A first prototype will be ready in June 2024, and a first version of the game will be inserted in the second version of the GenB educational toolkits to be used by kids, their families and teachers in Europe.

4.1.4 Language versions

The 9 language versions will be available on the GenB website at https://www.genb-project.eu/ by December 2024.

4.1.5 Conclusions

The main lesson learnt is that the process of co-design and validation of an education game for kids and teenagers requires many steps and expertise that must be considered to have a quality product which reflects the scientific and educational goals foreseen.

4.2 Role play card game “BioHeroes: Let’s save the planet!” (T1.4 b3)

See section 3.2.

4.3 Video teasers and educational videos (T1.4 d2)

4.3.1 Introduction

Three types of resources have been developed to generate bioeconomy materials for the GenB toolkit through video teasers and educational videos:

1. Production of video teasers and educational videos specifically for the GenB toolkit.
2. Production of video teasers and educational videos in the framework of the GenB project during events held in partner countries, to be included in the GenB toolkit.
3. Selection of video materials produced by third parties, to be included in the GenB toolkit.

The video teasers and educational videos tool has been used to generate materials aimed at the three age targets of young people. Some videos target only one age group, others prove to be interesting for two or all three age targets. Appendix 2 gives an overview of the developed videos and their target group.

For the age group 9-13 years, two videos have been produced or are planned for production. 3 videos have been carefully selected from previous projects. These videos fall into three categories within the GenB project framework and are shown in Table 6. Information on each of them is provided in the "developed materials" section.

Type of the content	Name of the video	9-13 y.o.
Video teasers and educational videos specifically for the GenB toolkit	"What's Bioeconomy?" with GenB Ambassadors (educational video)	
	Video teaser 1: "Bio-based products" (with GenB Ambassadors)	X
	Video teaser 2: "Controversial Issues" (with GenB Ambassadors)	
Video teasers and educational videos in the framework of the GenB project during events held in partner countries, to be included in the GenB toolkit	Video reading "The Apple That Wanted to Travel" fairy tale	X
	TEDx pitches	
Video materials produced by third parties, to be included in the GenB toolkit	"What's Bioeconomy? Book for kids"	X
	"A Bio-based day"	X
	"The Bioeconomy starts here"	X
	Videos about bio-based materials and products (video series)	
	Videos "Young Bioeconomy Entrepreneurs"	

Table 6. Video teasers and educational videos in the 9 to 13 y.o. target group

4.3.2 Methodological approach

The methodological approach is described in the section 3.2.2.

4.3.3 Developed and selected materials

Video teasers and educational videos specifically for the GenB toolkit

Video teaser 1 "Bio-based products" (with GenB Ambassadors). The description of this video can be found in section 3.3.3

Video teasers and educational videos in the framework of the GenB project during events held in partner countries, to be included in the GenB toolkit

Video reading "The Apple That Wanted to Travel". The description of this video can be found in section 3.3.3

Video materials produced by third parties, to be included in the GenB toolkit

Regarding the selected video materials, here below the most suitable videos are listed, a brief description is provided in section 3.3.3

What's Bioeconomy? Book for kids teaser. The description of this video can be found in section 3.3.3

A Bio-based day. The video (Figure 15) starts asking a question: *Is it possible to adopt a more sustainable lifestyle? Products from renewable sources today represent a possible choice. In the video, it is described a day in which many fossil-based products can be replaced by bio-based products.* This video was developed under the project Biobridges, a European project funded by BBI JU (Bio Based Industries Joint Undertaking), with the aim of improving the marketability of bio-based products by promoting close cooperation between industries, brands and consumers. The video is available in English, Italian, Spanish, Portuguese, Croatian, Slovak, Estonian and German. It is available in YouTube: *https://www.youtube.com/playlist?list=PLtcmfwGu2PB3NdW5cwMb2ciiOdfyVtvvL*

Figure 15. A Bio-Based day screenshoot

The bioeconomy starts here. The description of this video can be found in section 3.3.3

4.3.4 Expected final outcomes

During the activities in WP2 and in WP3 with the GenB Ambassadors, some videos suitable for this target age could be produced. These videos will be added to the final version of the toolkits.

4.3.5 Language versions

It is expected that not all the videos collected through this process will be multilingual, but they will be in the language of the country where they are produced. The possibility to produce linguistic versions will be evaluated case by case, depending on budget availability (since this is an additional effort not foreseen in the DoA)

4.3.6 Conclusions

See section 3.3.5

4.4 Hands-on experiments (T1.4 j)

See section 3.4

4.5 Participatory photography (T1.4l)

See section 3.5

5 Toolkits for High school (14-19 y.o.)

The toolkit for young people in High school consists of a total of four materials. They are identified in Task 1.4 as follows:

- Task 1.4 b: Bioeconomy quizzes and educational cards for social media
- Task 1.4 d: Video teasers and educational videos for 14-19 y.o.
- Task 1.4 e: Online factsheets “bioeconomy job profiles”
- Task 1.4 b2: Educational game

Each of these tasks are described sequentially in the following sub-sections.

5.1 Bioeconomy quizzes and educational cards for social media (T1.4 c)

5.1.1 Introduction

Currently, the bioeconomy emerges as a field of vital importance, fusing concepts of sustainability, innovation and economic development based on biological resources. In order to foster understanding and interest in this fascinating field, quizzes and educational cards have been designed that not only entertain, but also educate and challenge participants.

The quizzes and educational cards cover various topics related to the bioeconomy, from the production of bioplastics, plastics, bioenergy, food & compost, renewable energy to professional opportunities in the sector, among others. This comprehensive approach allows the target group to explore and consolidate their knowledge in key areas of the bioeconomy in an entertaining way.

The inclusion of the quizzes in social media formats provides a playful approach to learning. Participants are immersed in a fun and competitive environment, where bioeconomy information is presented in an accessible and stimulating way.

We are pleased to express our sincere thanks to Professor Yogesh Kumar from Jawahar Navodaya Vidyalaya, situated in Karimganj, Assam, India, under the Navodaya Vidyalaya Samiti, and Professor Nikola Delevski from DSU-RCSOO "Nikola Karev" in Strumica, North Macedonia for their valuable contributions to the scientific-technical validation of the bioeconomy-related content. Their experience and expertise have significantly enriched our work and provided an expert perspective that has strengthened the quality and relevance of the materials developed.

5.1.2 Methodological approach

The methodological process followed to develop the quizzes and educational cards is detailed below. In a first stage, a thorough identification and selection of the most reliable and relevant secondary sources for the target audience of the toolkit was carried out. This process was based on a careful review of the sources collected during Task 1.2 GenB resources Library, among

which the following European funded projects stand out: BIOWAYS[7], Bloom[8], Transition2bio[9], Biovoices[10] as well as results obtained in the GenB project itself.

The first review of these sources led to the creation of 41 quizzes and 20 educational cards. To ensure both the accuracy of the scientific and technical content and its suitability for the target audience, the material was subjected to a thorough review. This review was conducted by partner BTG, resulting in the rejection of some proposed questions and flashcards as unsuitable for the target audience, as well as the suggestion of new topics that better aligned with the target audience.

Subsequently, the content was subjected to a second evaluation, this time by two professors specialised in bioeconomics (see Table 2Table 7 for details).

Teacher's name	Yogesh Kumar	Nikola Delevski
School name	Jawahar Navodaya Vidyalaya, under Navodaya Vidyalaya Samiti	DSU-RCSOO "Nikola Karev"
Location	Karimganj Assam India	Strumica, North Macedonia

Table 7. Evaluators sample description

A total of 10 quizzes and 14 educational cards have been developed for the target group. Once the suggested improvements have been implemented, the final material will be translated into different languages, as detailed in section 5.1.4.

5.1.3 Developed materials

The GenB website hosts the quizzes[11] and the educational cards[12]. The content of the material developed is detailed below.

Quizzes

1. Are all bio-based plastics biodegradable? – Answer: B
   A) Yes
   B) No
2. Can bio-based plastics be recycled? –Answer: A
   A) Yes
   B) No
3. The dominant application for bio-based plastics is… - Answer: B
   A) Automotive
   B) Packaging
   C) Footwear

[7] BIOWAYS (grant agreement No. 720762) https://www.bioways.eu/
[8] Bloom (grant agreement No. 773983) https://bloom-bioeconomy.eu/
[9] Transition2bio (grant agreement No. 101000539) https://www.transition2bio.eu/
[10] Biovoices (grant agreement ID: 774331) https://www.biovoices-platform.eu/registeredarea/index
[11] Visit https://www.genb-project.eu/resources/toolkits/bioeconomy-quiz/
[12] Visit https://www.genb-project.eu/resources/toolkits/bioeconomy-educational-cards/

4. Where are bio-based plastics recycled? – Answer: A
    A) Chemical recycling plants
    B) They cannot be recycled
    C) They decompose in the ground
5. You can make fuel out of: – Answer: A, B, C, D
    A) Wood
    B) Used Cooking Oil
    C) Sugar beets
    D) Horse poop
6. In what forms can biofuel be presented? – Answer: D
    A) Solid
    B) Liquid
    C) Gas
    D) All of them
7. What are barriers to the development of the biofuel market? – Answer: D
    A) High production cost
    B) Lack of affordable raw materials
    C) Insufficient infrastructure
    D) All of them
8. In what areas does the bioeconomy work? – Answer: D
    A) Agriculture
    B) Production and manufacturing
    C) Forestry and fishing
    D) All of them
9. What is the primary goal of integrating renewable energies into the bioeconomy? – Answer: B
    A) Maximizing the use of non-renewable resources
    B) Reducing reliance on fossil fuels and promoting sustainability
    C) Ignoring environmental concerns in energy production
10. Bioeconomy… - Answer: D
    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

Educational cards

Educational card #1:

<u>WHAT IS THE DIFFERENCE BETWEEN COMPOSTABLE AND BIODEGRADABLE?</u>

Compostable materials undergo controlled decomposition in specific conditions (with heat, humidity, and oxygen) to produce nutrient-rich compost. In contrast, biodegradable materials break down naturally over time due to environmental factors. It's important to note that while all compostable materials are biodegradable, the reverse is not always true.

Educational card #2:

WHAT COMMON SOURCES OF RENEWABLE ENERGIES ARE THERE?

SOLAR ENERGY: Solar energy stands as the most abundant among all energy resources and is accessible even in overcast weather.

WIND ENERGY: Wind energy captures the kinetic energy of moving air by deploying large turbines placed on land (onshore) or in sea- or freshwater environments (offshore).

GEOTHERMAL ENERGY: Extracting heat from the Earth's internal reservoirs, geothermal energy is harnessed through wells.

HYDROPOWER: Hydropower captures the energy of water flowing from higher to lower elevations, generated from both reservoirs and rivers.

OCEAN ENERGY: Ocean energy originates from technologies that harness the kinetic and thermal energy of seawater, utilizing phenomena such as waves or currents to generate electricity or heat.

BIOENERGY: Bioenergy utilizes various organic materials like wood, crops, agricultural residues, and wastes such as straw and corn cobs. These can be directly burned for heating or power generation or can be converted into transport biofuels.

Educational card #3:

WHAT IS BIOECONOMY?

Bioeconomy refers to the production of renewable biological resources and their transformation into value-added products. These products include food, feed, bio-based materials, and bioenergy. By strengthening the bioeconomy, we move closer to a circular and low-carbon economy.

Educational card #4:

WHAT ARE THE BENEFITS OF BIOECONOMY?

Transitioning to a bio-based economy brings various advantages, such as reducing greenhouse gas emissions, diminishing reliance on fossil resources, better management of natural resources, and enhanced food security. This shift also generates employment in both urban and rural settings. Additionally, the creation of new non-food markets for agriculture, coupled with alternative income sources for farmers, can significantly boost rural areas.

Educational card #5:

WHAT IS A CIRCULAR BIOECONOMY?

A circular bioeconomy represents an economy driven by nature, introducing a novel economic model that prioritizes the utilization of renewable natural capital and aims to minimize waste. It seeks to replace the broad spectrum of non-renewable, fossil-based products currently in use with more sustainable alternatives. This approach stands apart from existing systems, emphasizing prolonged material use and implementing practices to reduce emissions. Land and marine ecosystems, along with production sectors like agriculture and forestry, operate

intentionally in a circular fashion, utilizing scientific approaches and technological innovations to create more sustainable materials and foster regeneration.

Educational card #6:

WHAT ARE WASTE STREAMS?

Waste is the residue left when a compound or a product reaches the end of its initial usefulness. Waste streams are flows of specific waste, from its source through to recovery, recycling, or disposal. Waste streams can be divided into two main categories: material-related streams (including metals; glass; paper and cardboard; plastics; wood; rubber; textiles; bio-waste) and product-related streams (including packaging; electronic waste; batteries and accumulators; end-of-life vehicles; mining, construction, and demolition waste).

Educational card #7:

WHAT IS WASTE VALORISATION?

Waste valorisation involves the processing of residues/by-products into raw materials, use of discarded products as raw materials or energy sources, application of waste materials in manufacturing processes, or other upgrading of waste materials.

Educational card #8:

WHAT IS RECYCLING, DOWNCYCLING AND UPCYCLING?

Recycling is defined as the process through which waste is recovered and reprocessed into new useful products. Recycling is one of the most common waste valorisation activities. The conversion process often involves a downgrading into raw inputs that are used in a new process. Downcycling is that waste recycling process in which the recycled material is of lower quality and functionality than the original material, due to the loss of some physical-mechanical properties. On the contrary, upcycling implies the reuse of waste so that the new product or material presents a higher quality, value, or function than the original one. Therefore, upcycling is preferred for the valorisation of waste.

Educational card #9:

WHAT IS COMPOSTING?

Composting is a form of organic recycling in a specific environment. In the composting process, organic waste is broken down by microbial digestion to create compost. To obtain stable, sanitized products for use in e.g., agriculture, organic waste must be treated under managed conditions (temperature, moisture and oxygen content). Industrial composting facilities meet the requirements of a controlled environment and high temperatures (between 50 ^{0}C and 60 ^{0}C). In home composting (in a backyard or in a special composting bin) temperatures are lower and the environment is not controlled.

Educational card #10:

WHAT IS BIODEGRADATION?

Biodegradation is a natural chemical process during which microorganisms convert organic materials into simple molecules such as carbon dioxide, methane, nitrate/ammonium, and water. Like the way we convert the food that we eat. When a material is called biodegradable, it can be returned to nature without having a harmful impact on the environment. Wood, paper, and food waste are some examples of biodegradable materials. Ultimately and over time everything will biodegrade in the environment, therefore the term "biodegradable" should always be associated with the type of medium (e.g. soil, water, in vitro medium), the conditions (e.g. temperature, humidity, oxygen content) and the duration of the biodegradation. Even when disposed properly, many synthetic man-made materials such as plastic, batteries and glass can take hundreds or even thousands of years to decompose in the environment.

Educational card #11:

WHAT DOES RENEWABLE MEAN?

A renewable resource is a material, energy, or water source that is never used up or that can be replaced by new growth after human extraction within a finite amount of time.

Educational card #12

WHAT DOES BIO-SOURCED MEAN?

A material or ingredient is called bio-sourced when it has a biological or biochemical source. Bio-sourced refers to the natural origin of the components, derived from renewable biomass sources, such as plants, animals, bacteria, or fungi (mushrooms).

Educational card #13

WHAT DOES ORGANIC MEAN?

Organic matter is any material produced originally by living organisms (plant or animal) that is returned to the soil. It covers a wide range of things like lawn clippings, leaves, stems, branches, moss, algae, lichens, any parts of animals, manure, droppings, sewage sludge, sawdust, insects, earthworms and microbes

Educational card #14

BIOWASTE

Biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises, and comparable waste from food processing plants". (Source: https://environment.ec.europa.eu/topics/waste-and-recycling/biodegradable-waste_en).

The term "Biodegradable waste" has a much broader scope, and includes forestry and agricultural residues, animal waste, manure, sewage sludge, or other biodegradable waste such as natural textiles, paper, or processed wood as well.

Content layout formats

The quiz is designed in two formats: printable format and online format (Figure 16, left-right respectively). The printable formats are ready to play cards, so that they can be used in physical contexts such as in the classroom. The online format is designed to be used in social networks.

Figure 16. Print at home format (left) and online format (right)

The educational cards are designed in two formats: site and carousel (Figure 17, left-right respectively). The site format, with horizontal dimensions, is intended for use in website environments, while the carousel format, with square dimensions, is designed for posting on social media.

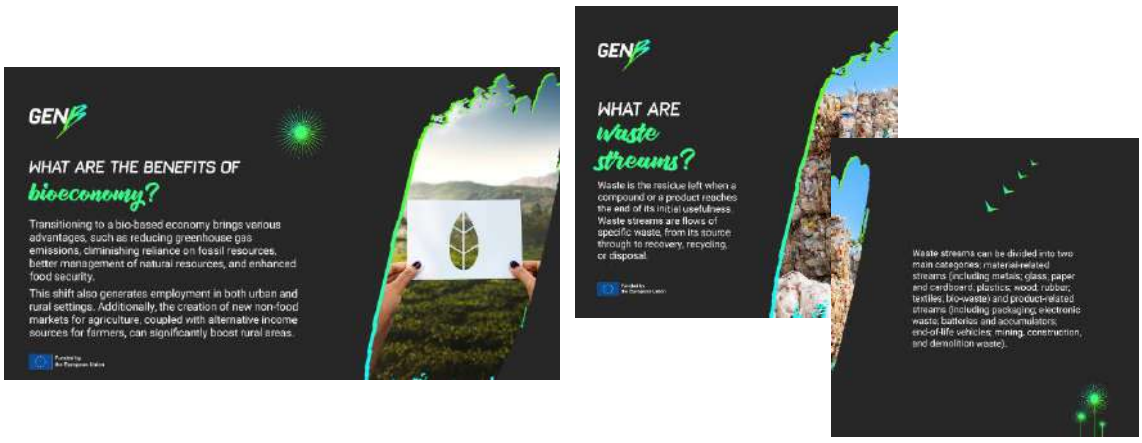


Figure 17. Educational card site format (left) and carousel format (right)

Expected final outcomes

Quizzes and educational cards tool has served as the basis for the development of the Contest 'The (shitty) Golden Ticket' (T1.4 n) tool, which focuses on boosting collaboration among

stakeholders. The dynamics proposed in the contest can also be used in formal and non-formal educational contexts with young people (see section 8.1).

Expected final outcomes

Although the commitment made in the DoA has been fulfilled -a total of 20 quizzes and educational cards for social media and training have been developed-, the need to expand the number of quizzes and educational cards to address specific areas of interest identified by the two teachers who participated in the second scientific-technical validation of the content is anticipated. Specifically, the inclusion of topics such as life cycle analysis and biomimetic will be considered internally. Furthermore, the possibility of incorporating some additional contexts or real-world examples, as well as visual aids, will be explored. These developments will be inserted in the second version of the GenB educational toolkits.

5.1.4 Language versions

The 9 language versions will be available on the GenB website at https://www.genb-project.eu/ by December 2024.

5.1.5 Conclusions

After completing the design process of the bioeconomy quizzes and educational cards and submitting it to two rounds of validation with experts in the field, we have reached several important conclusions. Firstly, the feedback received during the validations has been invaluable in improving the quality and accuracy of the content, as well as ensuring its relevance to the target audience. Secondly, the layout of the results in attractive and adaptable formats for using in both physical and digital environments such as websites and social media ensures wide accessibility and dissemination of the information. Taken together, these findings support the effectiveness of the design process in creating bioeconomy educational resources that are both informative and visually appealing, which will contribute to greater awareness and understanding of this important topic among the target groups.

5.2 Video teasers and educational videos (T1.4 d3)

5.2.1 Introduction

Three types of resources have been developed to generate bioeconomy materials for the GenB toolkit through video teasers and educational videos:

1. Production of video teasers and educational videos specifically for the GenB toolkit.
2. Production of video teasers and educational videos in the framework of the GenB project during events held in partner countries, to be included in the GenB toolkit.
3. Selection of video materials produced by third parties, to be included in the GenB toolkit.

The video teasers and educational videos tool has been used to generate materials aimed at the three age targets of young people. Some videos target only one age group, others prove to be interesting for two or all three age targets. Appendix 2 gives an overview of the developed videos and their target group.

For the age group 14-19 years, four videos have been produced or are planned for production and four videos have been carefully selected from previous projects. These videos fall into three categories within the GenB project framework and are shown in Table 8. Information on each of them is provided in the "developed materials" section.

Type of the content	Name of the video	14-19 y.o.
Video teasers and educational videos specifically for the GenB toolkit	"What's Bioeconomy?" with GenB Ambassadors (educational video)	X
	Video teaser 1: "Bio-based products" (with GenB Ambassadors)	X
	Video teaser 2: "Controversial Issues" (with GenB Ambassadors)	X
Video teasers and educational videos in the framework of the GenB project during events held in partner countries, to be included in the GenB toolkit	Video reading "The Apple That Wanted to Travel" fairy tale	
	TEDx pitches	X
Video materials produced by third parties, to be included in the GenB toolkit	"What's Bioeconomy? Book for kids"	
	"A Bio-based day"	X
	"The Bioeconomy starts here"	X
	Videos about bio-based materials and products (video series)	X
	Videos "Young Bioeconomy Entrepreneurs"	X

Table 8. Video teasers and educational videos in the 14 to 19 y.o. target group

5.2.2 Methodological approach

For the videos developed by GenB, here below are described the methodological steps to follow:

- FVA initiate the process by proposing the idea and format for each video, along with drafting a script. This process takes place also in collaboration with some GenB Ambassadors particularly interested in social media communication;
- This script undergoes validation by partners possessing strong scientific expertise, such as BTG, ensuring accuracy and relevance to circular bioeconomy principles;
- Each partner translates the script into national languages, facilitating broader accessibility;
- Mobilisating and Collaborating with GenB Ambassadors, the videos are then produced, leveraging their diverse perspectives and outreach capabilities.

Some videos are and will be produced during events in partners' countries. These videos will be added to the final version of the toolkits. It is expected that not all the videos collected through this process will be multilingual, but they will be in the language of the country where they are produced. The possibility to produce linguistic versions will be evaluated case by case,

depending on budget availability (since this is an additional effort not foreseen in the grant agreement).

Together with the internally developed videos, a comprehensive selection process was undertaken to identify additional contents for inclusion in the toolkit. This entailed extensive research encompassing both EU project-generated videos and those produced by the European Commission, selecting the most effective and successful materials.

By integrating both internally developed and externally sourced videos, the toolkit offers a diverse array of content, enriching the educational experience and maximizing impact in raising awareness about circular bioeconomy.

5.2.3 Developed and selected materials

Video teasers and educational videos specifically for the GenB toolkit

What's Bioeconomy? with GenB Ambassadors (educational video). In the creation of our educational video, mainly focused on the explanation of What's bioeconomy and real-life applications, we imagined a dynamic narrative that features various GenB Ambassadors delivering distinct sentences, aligned with the script provided below. This approach adds depth and diversity to the storytelling, as each ambassador brings their unique voice and perspective to elucidate the concept of bioeconomy. The video will be edited to integrate these different voices, creating a cohesive and engaging narrative about what bioeconomy entails. To ensure accessibility and reach, the video will be recorded in English, supplemented with subtitles in the languages of all GenB countries.

Up to now, translations from partners have been collected (SK, EN, IT, DE, NL, PT, SP), and the GenB Ambassadors have been mobilised to produce the materials. The main problem is that the GenB Ambassadors are located in different countries, and they cannot reach a common place for the video shooting. This question raises the risk of having self-recorded videos with different quality and style, therefore a document with the guidelines for self-recording have been prepared by FVA. It is foreseen that the video will be launched before summer 2024.

***

Script:

"Hey, guys! Have you ever wondered what bioeconomy is?

Bioeconomy? What's that?

It's actually a pretty cool concept. Bioeconomy is all about using renewable biological resources like crops, trees, fish, animals, micro-organisms and also...organic waste!

the so-called biomass, which can be used to produce food, feed, energy and materials in a more circular and sustainable way.

Circular because Bioeconomy promotes the valorisation of residues and waste as raw materials.

Sustainable because it doesn't harm the environment and preserves the resources for future generations.

"From agriculture to healthcare, bioeconomy and bio-based products touch on many aspects of our lives."

Can you guess some examples?

clothing from natural fibres like flax and hemp

insulation from fungi,

and from wood, not only furniture and flooring but also textiles, for example from pruning residues

nutraceuticals from tomato, blueberries and fishery waste

bioplastics from thistle and crops by-products, like wheat

Let's not forget biofuels! They can be derived from unexpected sources like waste cooking oil or even algae...

Developing new bio-based products through research and innovation is an engine for sustainable development and economic growth, creates new jobs and businesses, also for young people, and new opportunities for rural areas.

Bioeconomy plays a central role in the challenges that we are facing like addressing climate change and pollution, reducing greenhouse gas emissions, achieving the Sustainable Development Goals (SDGs), protecting biodiversity and soils, ensuring healthy food for all, addressing energy needs, mitigating resource scarcity.

That's what bioeconomy is all about – shaping a sustainable future for generations to come.

We are the GenB Ambassadors, follow @BIOVOICES to discover more about the bioeconomy from our voices."

***

Video teaser 1: "Bio-based products" (with GenB Ambassadors). The description of this video can be found in section 3.3.3

Video teaser 2: "Controversial Issues" (with GenB Ambassadors). In this teaser, GenB Ambassadors will address controversial topics within circular bioeconomy, through an engaging reel-quiz format. Each GenB Ambassador will pose a question related to a controversial issue and then will provide the correct answer, fostering reflection on complex aspects of circular bioeconomy practices.

Video teaser 2: "Controversial Issues" (with GenB Ambassadors) is planned to be produced in the following months, specifically when the GenB Ambassadors will be trained in T3.2. For the first video, the need to have the Bio-Based products physically in the hands of the GenB Ambassadors, force the project to organise the shooting involving only small groups of

ambassadors located in the same country. To make sure that all the Ambassadors are somehow involved, new ideas and formats for self-recording are discussed. It should be taken into consideration that some Ambassadors have a basic knowledge of English language. FVA is designing a format enabling them to record the contents without speaking (using written wording, e.g. for the controversial issues).

Video teasers and educational videos in the framework of the GenB project during events held in partner countries, to be included in the GenB toolkit

TEDx pitches. During the European Researchers' Night in Italy (September 2023), the recording of the TEDx delivered by 8 GenB Ambassadors was done (Figure 18). This video was edited and uploaded in the project's channel in YouTube[13] and it can be added in the Italian toolkit.

Figure 18. TEDx pitches with GenB Ambassadors.

Video materials produced by third parties, to be included in the GenB toolkit

A Bio-based day. The description of this video can be found in section 4.3.3

The Bioeconomy starts here. The description of this video can be found in section 3.3.3

Videos about bio-based materials and products[14] (video series). This video series (Figure 19), produced by BioCannDo project, presents several bio-based products and related curiosites.

[13] Visit https://www.youtube.com/watch?v=SfCR1Of_h0Q&t=416s
[14] Visit https://www.youtube.com/playlist?list=PLSTmtfw-s6X1_sE6rFz-4sXjE31L4M3IW

Figure 19. Videos about bio-based materials and products screenshoot

Videos "Young Bioeconomy Entrepreneurs[15]". They are produced by Transition2Bio and BIOBec projects (Figure 20). A set of 9 video interviews with young changemakers in the bioeconomy.

Figure 20. "Young Bioeconomy Entrepreneurs screenshoot

5.2.4 Expected final outcomes

The video production was initiated following the first capacity building (Basic Level 1) session, held at the beginning of April. However, further training is required for the GenB Ambassadors before involving them in this specific task, to be sure they are sufficiently equipped with the skills and knowledge essential for effectively contributing to the video production process (especially the video teasers, which will be part of GenB social media campaigns). Therefore, the completion of this task is foreseen that the video will be launched before summer 2024.

[15] Visit https://www.youtube.com/playlist?list=PLbA125z357wRCKgsNBP8Yskd4kR33MJPO

5.2.5 Language versions

This material has been translated into several languages. Access the different versions by visiting the GenB project website at https://www.genb-project.eu/

5.2.6 Conclusions

See section 3.3.5

5.3 Online factsheets "bioeconomy job profiles" (T1.4 e)

5.3.1 Introduction

The bioeconomy job profiles represent a set of educational resources designed for high school teachers who teach students aged 14-19 and include career related online factsheets and interviews with experts working in the field.

The career related online factsheets represent an overview of the expert's job, with detailed explanation of the inspiration that led him/her to pursue this career, typical tasks he/she performs during the day, key skills and the education and career path he/she pursued to become an expert. In addition, the document refers to the challenges and expert's favourite parts of his/her work, how he/she contributes to a better world, and offers tips for students, as well as teachers and parents to inspire youth to pursue a career in the field.

The video interview serves as a supporting material, with a more extensive overview of the expert's career.

The purpose of these materials is to inform students and inspire them to pursue careers and take advantage of educational opportunities in the field of bioeconomy. Each of the bioeconomy job profiles is based on the insights and experiences of professionals in the different sectors, holding various positions and expertise in the field. These formats allow teachers to raise students' interest towards bioeconomy from the perspective of the various STEM and non-STEM fields that play an important role in the transition to circular and more sustainable lifestyles.

EUN has collaborated with four experts in bioeconomy, working in different sectors and positions, and has developed four sets of Job profiles.

5.3.2 Methodological approach

Bioeconomy job profiles were developed in collaboration with four experts working in various positions in the field of bioeconomy. The bioeconomy career factsheets were developed based on the STE(A)M IT project career profiles (see STE(A)M IT project repository of STEM Careers for reference[16]). The template was then shared with LOBA, the consortium partner who took care of editing the template according to the project visual identity. The career factsheet-template was then made available to the experts to be completed according to their professional knowledge and experience. Upon receipt of the template with the experts' input, the content was proofread, and revised by BTG, consortium partner and expert in the topic.

[16] Visit https://steamit.eun.org/category/stem-careers/

The factsheets have been developed and filled in English language, and then translated into eight additional languages by the consortium partners. The factsheets are available in: English, Dutch, German, Greek, Italian, Portuguese, Slovak and Spanish languages.

In addition to the career factsheet, an interview was conducted with each of the experts, in which they explained their experience and expertise, providing more details about their education, key skills, challenges and everyday tasks of their job. The interviews were recorded by EUN, whilst LOBA edited and merged the recordings to fit GenB's visual identity. The interview recordings will be accompanied by subtitles in eight (8) languages: English, Dutch, French, German, Greek, Italian, Portuguese, Slovak and Spanish. The subtitles have been machine translated and will be proofread by the consortium partners and incorporated by LOBA in the videos.

5.3.3 Developed materials

As part of the project, EUN has developed four job profiles. Due to some delays of the 4th video interview, three out of four GenB Job Profiles are currently published and available on the Scientix Resource repository[17] and the GenB Virtual library[18]. At this stage, the remaining job profile is in the production and will be available on the corresponding websites, by the time this deliverable is submitted.

In the following section, images and links towards the specific job profiles will be presented. Specifically, the information will be provided for:

- GenB Job Profile: Kateryna Ivanova, Research Fellow/ Research Assistant.
- GenB Job Profile: Paola Varela Pérez, Social Entrepreneur and Bioeconomist.
- GenB Job Profile: Miquel Minguet, Manager in the field of Bioeconomy.
- GenB Job Profile: Luc van Schie, Business Development Manager.

Job profile 1. Kateryna Ivanova, Research Fellow/ Research Assistant

A sample of the layout of the online factsheet and video interview is shown on the Figure 21. Access links to the GenB Job Profile in Scientix Resource Repository[19] and GenB Virtual Library[20]

[17] Visit https://www.scientix.eu/resources
[18] Visit https://www.genb-project.eu/resources/bioeconomy-job-profiles/
[19] Visit https://www.scientix.eu/resources/details?resourceId=130196
[20] https://www.genb-project.eu/resources/bioeconomy-job-profiles/bioeconomy-job-profiles-meet-kateryna-ivanova/

Figure 21. Career Factsheet front page: Kateryna Ivanova, Research Fellow/ Research Assistant (left) and Interview with Expert: Kateryna Ivanova, Research Fellow/ Research Assistant (right)

Job profile 2. Paola Varela Pérez, Social Entrepreneur and Bioeconomist

A sample of the layout of the online factsheet and video interview is shown on the Figure 22. Access links to the GenB Job Profile in Scientix Resource Repository[21] and GenB Virtual Library[22].

Figure 22. Career Factsheet front page: Paola Varela Pérez, Social Entrepreneur and Bioeconomist (left) and Interview with Expert: Paola Varela Pérez, Social Entrepreneur and Bioeconomist

Job profile 3. Miquel Minguet, Manager in the field of Bioeconomy

A sample of the layout of the online factsheet and video interview is shown on the Figure 23. Access links to the GenB Job Profile in Scientix Resource Repository[23] and GenB Virtual Library[24]

[21] Visit https://www.scientix.eu/resources/details?resourceId=130158
[22] Visit https://www.genb-project.eu/resources/bioeconomy-job-profiles/bioeconomy-job-profiles-meet-paola-varela/
[23] Visit https://www.scientix.eu/resources/details?resourceId=130146
[24] Visit Bioeconomy careers and skills for the future: meet Miquel Minguet (genb-project.eu)

Figure 23. Career Factsheet front page: Miquel Minguet, Manager in the field of Bioeconomy (left) and Interview with Expert: Miquel Minguet, Manager in the field of Bioeconomy (right)

Job profile 4. Luc van Shie, Business Development Manager

Access links to the GenB Job Profile:

- Scientix Resource Repository: as soon as they are available
- GenB Virtual Library: as soon as they are available

Expected final outcomes

The finalisation of one GenB Job Profile is pending. The delay was due to unforeseen circumstances regarding the unavailability of the assigned expert to conduct the required interview. The Career Factsheet has been proofread and translated to eight languages. French version will be available on the updated version of this deliverable in December 2024.

However the interview recording is pending editing. In the following weeks LOBA will edit the interview and provide the subtitles of the video for translation. Upon the finalization of the process, the 4th GenB Job Profile will be published on both Scientix Resource Repository and the GenB Virtual Library.

Additionally, the translations of the video subtitles are delayed and will be finalized and included in the GenB website, by 31 May 2024.

5.3.4 Language versions

This material has been translated into eight languages (EN, IT, GE, NL, SP, PT, GR, SL). Access the different versions by visiting the GenB project website at https://www.genb-project.eu/ French will be available by December 2024.

5.3.5 Conclusions

In conclusion, the bioeconomy job profiles have been created to introduce high school students and their teachers to exciting careers in bioeconomy, to inspire students to pursue such careers and to help them understand the skills necessary. The use of online factsheets proves to be an extremely useful tool for disseminating information on biodiversity. These resources provide a user-friendly format where diverse audiences can access comprehensive and up-to-date

information on various aspects of biodiversity and careers in bioeconomy. By providing visually appealing and easily accessible content, online factsheets have the potential to improve awareness and understanding of biodiversity among high school students. In addition, their digital format allows for easy sharing and dissemination through different online platforms, further extending their reach and impact. Together with an explanatory video of the real-life experience of a profesional working in the bioeconomy, these tools offer an effective way to promote biodiversity conservation and foster a greater appreciation for the natural world.

5.4 Educational game “Escape4Future - Chemistry meets Circular Bioeconomy” (T1.4 b2)

5.4.1 Introduction

The “Escape4Future - Chemistry meets Circular Bioeconomy” game is the outcome of the Italian Living Lab, which involved the High School ITT Montani (Fermo, Italy), as described in details in D1.2.

5.4.2 Methodological approach

During the living lab, several onsite and online workshops took place in order to develop the escape game. In summary (details are described in D1.2), FVA introduced the concepts of Bioeconomy and of the escape game, providing examples and tips for designing enigmas. Participants brainstormed ideas for the game's title, scenario, puzzles, and where it would be implemented. Subsequent workshops refined the game's structure, content, and experiments, with teachers validating and contributing to the process.

5.4.3 Developed materials

The “Escape4Future - Chemistry meets Circular Bioeconomy" engages students and parents in solving six interconnected enigmas that address green chemistry and bioeconomy issues through hands-on experiments or games. The objective is to find the way out to a more sustainable and circular lifestyle. Figure 24 shows the implementation of the activity during the Living Lab.

The following section presents a brief description of the learning objectives related to each enigma and shows the holding of a workshop:

- Enigma 1: the problem of microplastics in the seas will be addressed through a hands-on experiment, involving the addition of plastics to several test tubes with salt water and the study of their behaviour. The result of the experiment will provide a key to access the next enigma.
- Enigma 2: Circular bioeconomy concepts will be introduced by solving a crossword puzzle. Once solved, some highlighted letters of the crossword will form a word-address, which will allow players to reach the next location to tackle the next enigma.
- Enigma 3: the topic of sustainable alternatives to microplastics added within cosmetics and the valorisation of secondary raw materials for the creation of bio-products will be addressed using a hands-on experiment consisting of a recipe, which explains how to

reuse renewable organic waste. Players will have to create an eco-friendly scrub (using coffee grounds) and trade it for a clue to continue in the game.

Figure 24. Escape4Future in action during Living Lab

- Enigma 4: Players will be given 24 numbered cards with information about different renewable feedstocks. Nine bio-products will be arranged on the table in a predetermined order. The goal is to correctly match raw materials and bio-products derived from them. Numbers will then be obtained from the cards, which, when read in order, will form a code that can open a lock on a box containing materials for the next experiment.
- Enigma 5: A hands-on experiment allows the player to evaluate the antioxidant power of biological residues (tea bag and waste oil) by combining them with reagents that "simulate" the aging process (oxidation). This enigma will introduce the theme of using renewable bio-based residues to fight aging and live healthier and longer. Players will have to identify the residue with the greatest antioxidant capacity, which will be associated with a number, needed to address the last enigma.
- Enigma 6: A newspaper article will be found by the players and will explore how hemp, insects, and manure may represent new resources in the bioeconomy. The article will contain key hints that will suggest to the players to use the Wood's lamp and uncover a message. The latter will open the lock associated with a box containing bio-based gadgets.

5.4.4 Language versions

Currently, the material is available in Italian and English. However, the possibility of translating it into additional languages will be considered by each partner since the content provided in this output goes beyond the scope outlined in DoA. It is expected that this material will soon be accessible on the GenB website.

5.4.5 Conclusions

The “Escape4Future - Chemistry meets Circular Bioeconomy" game was implemented and validated during several large-scale events in Italy, namely Maker Faire, Fermhamente Science Festival and the Italian Changemakers Festival – Rome Edition. Notably, in Fermhamente Science Festival, the game was played in a more simplified version, similar to an experiential learning game rather than a proper escape game. In fact, the age of the participants was very heterogeneous and involved also primary school students for whom the enigmas were too complex to solve, proving the flexibility and effectiveness of the format, even with other target ages. Adaptation of the game for younger targets will be studied in the future.

5.5 Participatory photography (T1.4l)

See section 3.6

6 Toolkit for teachers

The toolkit for teachers consists of lesson plans, training contents and MOOC, as identified in the Task 1.4. Each of the three materials is individually presented in the following sections:

- Task 1.4 f1: Educational and information packages for Pre- and Early- school
- Task 1.4 f2: Educational and information packages for Elementary school
- Task 1.4 f3: Educational and information packages for High school
- Task 1.4 g: Lesson plans
- Task 1.4 h: Training contents
- Task 1.4 i: MOOC
- Task 1.4 j: Hands-on experiments
- Task 1.4 k: Fairy tale
- Task 1.4 l: Participatory photography
- Task 1.4 m: Podcasts

Each of these tasks are described sequentially in the following sub-sections.

6.1 Educational and information packages (T1.4 f1, T1.4 f2, T1.4 f3)

6.1.1 Introduction

Three educational and information packages have been developed:

1. Educational and information packages for Pre- and Early- school (4-8 y.o.)
2. Educational and information packages for Elementary school (9-13 y.o.)
3. Educational and information packages for High school (14-19 y.o.)

Each of them contains the materials that are intended for this target group. Appendix 1 shows the relationship of each of the materials developed with the target group.

The aim of the educational and information packages is to elaborate a document which brings together all the materials developed for each young people target group in the GenB project. In addition, to provide educators with concrete tools and to integrate the teaching of the bioeconomy into their educational programs. The practical approach of the proposed toolkits aims not only to educate, but also to actively involve students in the learning process, turning theory into tangible and meaningful experience. It explores the multiple uses of these tools in teaching bioeconomy, highlighting their ability to promote innovation, creativity, and critical thinking among students.

The educational and information packages are mainly aimed at teachers, although the final target audience is young people.

6.1.2 Methodological approach

The development of this bioeconomy pedagogical toolkit has been the result of a meticulous and collaborative process. Beginning with a thorough review of the materials provided and

consultation of specialized sources, a solid foundation of knowledge about the principles of the bioeconomy and its educational importance was established.

With this basis, the content and pedagogical activities were created, prioritizing accessibility and interactivity for an effective learning experience. Multiple reviews of the material are being carried out with consortium partners, which will provide valuable feedback to improve and fine-tune the educational resources.

In summary, the methodology used is rigorous, collaborative and focused on ensuring the effectiveness and relevance of this bioeconomy pedagogical toolkit, with the aim of offering high-quality educational resources for teachers and, as the ultimate target beneficiary, students.

6.1.3 Developed materials

Guideline rationale

The creation of this didactic guide on bioeconomy arises from the prevailing need to educate new generations about the vital importance of adopting sustainable approaches in the management of natural resources and in the promotion of a circular economy. In a world where environmental and socioeconomic challenges are increasingly evident, it is essential to cultivate from an early age an active and conscious understanding of the principles of the bioeconomy and its impact on our future.

This guide has been carefully developed to address the fundamental concepts of the bioeconomy and present them in an accessible and attractive way for boys and girls of different ages. The practical approach of the proposed toolkits aims not only to educate, but also to actively engage students in the learning process, turning theory into tangible and meaningful experience.

In depth, the guide explores the multiple uses of toolkits in teaching the bioeconomy, highlighting their ability to promote innovation, creativity and critical thinking among students. The importance of teaching boys and girls about the valorization of biological resources, the optimization of production processes and the development of sustainable products is highlighted.

Furthermore, the positive impact that understanding the bioeconomy can have on society, both environmentally and economically, is emphasized. It seeks to foster collaboration and teamwork among students, inspiring them to seek innovative and sustainable solutions to current and future challenges.

This guide is not only limited to transmitting theoretical knowledge, but also aims to cultivate a proactive and committed attitude in students, encouraging them to become agents of change in their communities. It seeks to inspire critical reflection on the relationship between human activity and the environment, promoting the development of a sustainable mentality from an early age.

In summary, this teaching guide on using toolkits for teaching the bioeconomy not only provides essential educational tools, but also seeks to sow the seeds of critical thinking, innovation, and

environmental responsibility in young minds. It thus contributes to the formation of informed, conscious and committed citizens with the construction of a sustainable future for all.

Objectives

- Gain an understanding of the fundamental basic principles governing the bioeconomy and its importance for sustainable development.
- Raise awareness about the critical need to value biological resources as a fundamental step towards the conservation of biodiversity and the preservation of ecosystems.
- Develop solid practical skills for the effective application of bioeconomy concepts and methodologies in various contexts, thus facilitating the adoption of sustainable practices in daily life.
- Stimulate creativity and innovation by exploring new ways of addressing environmental and socioeconomic challenges through the application of the bioeconomy.
- Foster a culture of collaboration and teamwork among students, promoting the exchange of ideas and the co-creation of innovative solutions to bioeconomic problems.
- Cultivate a sustainable mindset rooted in the understanding of the interdependence between human actions and the environment, and in the active commitment to preserving natural resources for future generations.

Compiling materials for educational and informational packages targeting Pre- and Early- school (T1.4 f1)

The educational and information package intended for teachers who teach young people in Pre- and Early school consists of a total of seven new materials. They are identified in Task 1.4 as follows:

- Task 1.4 a: Book for kids “What’s Bioeconomy”
- Task 1.4 b3: Role play card game “BioHeroes: Let’s save the planet!”
- Task 1.4 d: Video teasers and educational videos for 4-8 y.o.
- Task 1.4 j: Hands-on experiments
- Task 1.4 k: Fairy tale
- Task 1.4 l: Participatory photography
- Task 1.4 m: Podcasts

The following describes the content of the Educational and information package for Pre- and Early- school (4-8 y.o.)

Book for kids “What’s Bioeconomy”

TITTLE OF THE ACTIVITY

Book for kids “What’s bioeconomy?

SHORT DESCRIPTION

“What is the Bioeconomy?” is a book written for children with the aim of raising awareness about the sustainable and circular bioeconomy, and particularly bioproducts. The book is aimed

at children aged 5 to 9, their families and teachers and promotes the circular and sustainable bioeconomy in a scientifically sound, easy and comprehensive way.

TIMES/TYPES/RESOURCES

TIME	LEARNING TYPE		TECHNOLOGY/MATERIALS
1 session of 1 hour	✓	*CREATE*	The book "What is the bioeconomy?" will be used in physical format, so that students can interact with it and discover the corners and secrets in the form of a flap that the book on bioeconomy hides. If the book is not available in physical format, it can be obtained online, interactively on the official "transition2bio" page to be able to project it in the classroom.
		DEVELOP	
	✓	*INVESTIGATE*	
	✓	*INTERACT*	
	✓	*PRESENT*	
		EXPLORE	

STEP 1	***Time: 1 session of 30 minutes***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***
SESSION 1 - Task 1: the teacher will divide the classroom into 7 groups (1 for each page of the book). - Task 2: the teacher will explain to the students that each group must investigate and take notes on the things that have surprised them the most about the bioeconomy.	SESSION 1 - Task 1: students will discover and take notes on important words and concepts from their part of the book.	SESSION 1 -Task 1: collection of information by students. -Task 2: research on the assigned topic.

STEP 2	***Time: 1 session of 30 minutes***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***

SESSION 2 - Task 1: the teacher will explain that the groups must present to the rest of the groups in the classroom the concepts that they have collected in their part of the book. - Task 2: the teacher will act as a guide (possible clarifications of the concepts) and will help the students.	SESSION 2 - Task 1: the students will explain in a short period of time the main aspects and important concepts that they have gathered about the bioeconomy to the rest of the class.	SESSION 2 - Task 1: Explanation and presentation in the classroom.

STAGE

Students from 4 to 8 years old

LEVEL

Each partner must fill out this field with the educational level to which the stage in their country corresponds. Example: SPAIN – Educación Infantil y Primaria

DOCUMENTATION

https://www.genb-project.eu/

Role play card game "BioHeroes: Let's save the planet!"

TITTLE OF THE ACTIVITY

"BioHeroes: Let's save the planet!"

SHORT DESCRIPTION

Our world is under threat from imbalance: only the bioeconomy can save it! Fortunately, there are 6 bioeconomy professions that, if they manage to carry out all their tasks, can stop the destruction of the planet. The aim of the game is simple but crucial: be the first to help the bioeconomy professions fulfil their tasks and keep the Earth safe. The aim of the game is to complete the profession cards by placing three task cards on each of them. The player who completes the most profession cards is the winner.

TIMES/TYPES/RESOURCES

TIME	LEARNING TYPE		TECHNOLOGY/MATERIALS
1 session		*CREATE*	Materials available in the board game instructions and tool.
	✓	*DEVELOP*	

of 30 minutes		*INVESTIGATE*	
	✓	*INTERACT*	
		PRESENT	
		EXPLORE	

STEP 1	***Time: 1 session of 10 minutes***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***
SESSION 1 - Task 1: the teacher will carefully read the instructions to understand the game and explain it to the students.	SESSION 1 - Task 1: the students will read the instructions in groups to understand the game.	SESSION 1 - Task 1: assimilation of game concepts and mechanics.

STEP 1	***Time: 1 session of 20 minutes***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***
SESSION 2 - Task 2: the teacher will divide the classroom into groups of 2 to 4 students. - Task 3: the teachers will carry out a first test game for the students to assimilate the game.	SESSION 2 - Task 2: once the instructions have been read, they will begin to separate the cards as indicated in the instructions and prepare to start the game. - Task 3: Play and enjoy the game!	SESSION 2 - Task 2: dynamization and interaction with the game, companions and their functioning.

STAGE

Students from 4 to 8 years old

LEVEL

Each partner must fill out this field with the educational level to which the stage in their country corresponds. Example: SPAIN – Educación Infantil y Primaria

DOCUMENTATION

https://www.genb-project.eu/

Video teasers and educational videos

TITTLE OF THE ACTIVITY

Video teasers and educational videos

SHORT DESCRIPTION

The use of videos is a powerful tool to capture interest and raise awareness about the circular bioeconomy, as these visual materials serve as effective means to convey and visualize practically complex concepts. By harnessing the power of storytelling and visual examples, GenB videos aim to captivate audiences, spark curiosity, and drive engagement in GenB.

TIMES/TYPES/RESOURCES

TIME	LEARNING TYPE		TECHNOLOGY/MATERIALS
1 session of X + 30 minutes		*CREATE*	Projector Computer/Tablet Internet connection
	✓	*DEVELOP*	
		INVESTIGATE	
	✓	*INTERACT*	
		PRESENT	
		EXPLORE	

Note: X minutes depends on the duration of the video teasers and educational videos

STEP 1	***Time: 1 session of X minutes***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***
SESSION 1 -Task 1: the teacher will prepare the videos for the students.	SESSION 1 -Task 1: students will watch the videos on bioeconomy.	SESSION 1 -Task 1: viewing videos and capturing concepts and aspects of the bioeconomy.

Note: X minutes depends on the duration of the video teasers and educational videos

STEP 2	***Time: 1 session of 30 minutes***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***

SESSION 2 -Task 2: the teacher will divide the classroom into various groups and assign them to watch the video again.	SESSION 2 - Task 2: students, in groups, will watch the video assigned by the teacher again and draw the main conclusions - Task 3: the groups will present the conclusions drawn from their video to the other students.	SESSION 2 -Task 2: presentation of ideas to the other members of the classroom.

STAGE

Students from 4 to 8 years old

LEVEL

Each partner must fill out this field with the educational level to which the stage in their country corresponds. Example: SPAIN – Educación Infantil y Primaria

DOCUMENTATION

https://www.genb-project.eu/

Hands-on experiments

TITTLE OF THE ACTIVITY

Hands-on experiments

SHORT DESCRIPTION

Practical experiments are a format used at GenB where young people actively participate in experiments with the aim of discovering many uses for bio-waste and seeing how it can be transformed into products. The practical experiments are aimed at young people of different age groups and can be used in formal, non-formal and informal educational settings.

TIMES/TYPES/RESOURCES

TIME	LEARNING TYPE		TECHNOLOGY/MATERIALS
1 session of 1 hour for each experiment	✓	*CREATE*	Templates with indications and instructions for the experiments, the list of materials and a brief explanation of the purpose of the workshop/experiment.
	✓	*DEVELOP*	
	✓	*INVESTIGATE*	
	✓	*INTERACT*	
	✓	*PRESENT*	

		EXPLORE	

STEP 1	***Time: 1 session of 1 hour***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***
SESSION 1 - Task 1: the teacher will explain to the students how to carry out some experiments on bioeconomy. - Task 2: the teacher will collect and provide the students with the materials necessary to carry out the experiments. - Task 3: the teacher will guide, accompany and offer all step-by-step instructions until the completion of the experiment.	SESSION 1 -Task 1: the students will pay attention to the experiment instructions. - Task 2: the students will inform the teachers about the use of objects and utensils that may be dangerous and will ask any questions they have.	SESSION 1 -Task 1: development of experiments to reinforce the practical activity on bioeconomy through a playful and enjoyable way.

STAGE

Students from 6 to 13 years old

LEVEL

Each partner must fill out this field with the educational level to which the stage in their country corresponds. Example: SPAIN – Educación Infantil y Primaria

DOCUMENTATION

https://www.genb-project.eu/

Fairy tale

TITTLE OF THE ACTIVITY

Fairy tale

SHORT DESCRIPTION

Fairy Tales is a tale aimed at children from 4 years of age, which aims to introduce the concepts of bioeconomy through storytelling. Storytelling is the most natural way to stimulate the curiosity and elicit learning in very young kids.

TIMES/TYPES/RESOURCES

TIME	LEARNING TYPE		TECHNOLOGY/MATERIALS
1 session of 30 minutes		*CREATE*	The material available will be the story in digital format. Projector Tablet/computer
		DEVELOP	
		INVESTIGATE	
	✓	*INTERACT*	
	✓	*PRESENT*	
		EXPLORE	

STEP 1	***Time: 1 session of 30 minutes***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***
SESSION 1 -Task 1: the teacher will present that they are going to read a story to introduce the concepts of bioeconomy. -Task 2: the teacher will ask the students to read the story to make them participate in the acquisition of knowledge.	SESSION 1 -Task 1: the students will read the story and write down or remember the concepts that were most important to them.	SESSION 1 -Task 1: interaction of students with reading and bioeconomy in a playful way.

STAGE

Students from 4 to 8 years old

LEVEL

Each partner must fill out this field with the educational level to which the stage in their country corresponds. Example: SPAIN – Educación Infantil y Primaria

DOCUMENTATION

https://www.genb-project.eu/

Participatory photography

TITTLE OF THE ACTIVITY

Participatory photography

SHORT DESCRIPTION

Through photographs (and/or video recordings), young people 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, through this format, young people (primary education classes) take photographs together with their families, who are actively involved as key players in lifelong learning.

TIMES/TYPES/RESOURCES

TIME	LEARNING TYPE		TECHNOLOGY/MATERIALS
1 session of 10 minutes 1 session of 20 minutes	✓	*CREATE*	Mobile phone/Tablet Projector Computer
		DEVELOP	
		INVESTIGATE	
	✓	*INTERACT*	
	✓	*PRESENT*	
	✓	*EXPLORE*	

STEP 1	***Time: 1 session of 10 minutes***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***
SESSION 1 -Task 1: the teacher explains to the students that they must take photos and videos about bioeconomy actions with their families and in everyday life.	SESSION 1 -Task 1: once the explanation is finished, the students will think and take the videos and photos in their homes and neighbourhoods.	SESSION 1 -Task 1: assimilation of tasks and interaction with aspects of the bioeconomy.

STEP 2	***Time: 1 session of 20 minutes***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***

SESSION 2 -Task 1: the teacher will recapitulate all the photos and videos sent by the students and will present them in class so that each student explains the context of their images and videos.	SESSION 2 -Task 1: the students explain, in turns, how they took the photos, where they took them and why they consider it to be an action related to the bioeconomy.	SESSION 2 -Task 1: presentation of images and interaction with other audiovisual materials of colleagues.

STAGE

Students from 4 to 8 years old

LEVEL

Each partner must fill out this field with the educational level to which the stage in their country corresponds. Example: SPAIN – Educación Infantil y Primaria

DOCUMENTATION

https://www.genb-project.eu/

Podcasts

TITTLE OF THE ACTIVITY

Podcasts

SHORT DESCRIPTION

Podcasts for children can provide a brilliant way of realising information and they can be played in the car, before bed to wind down or while the parents are cooking, doing jigsaws or colouring. Podcasts help children to focus and encourage their imaginations to expand.

TIMES/TYPES/RESOURCES

TIME	LEARNING TYPE		TECHNOLOGY/MATERIALS
1 session of X minutes		*CREATE*	Any device to play the podcast
		DEVELOP	
		INVESTIGATE	
		INTERACT	
		PRESENT	
	✓	*EXPLORE*	

Note: X minutes depends on the duration of the podcasts

STEP 1	***Time: 1 session of X minutes***

Teacher's role:	*Role of the students:*	*Type of interaction or educational activity:*
SESSION 1 -Task 1: the teacher will play the podcast chapters in the classroom.	SESSION 1 -Task 1: students actively listen to the podcast and will ask questions about the information that is reproduced.	SESSION 1 -Task 1: interaction of students with listening tales and bioeconomy in a playful way.

Note: X minutes depends on the duration of podcasts

STAGE

Students from 3 to 5 years old

LEVEL

Each partner must fill out this field with the educational level to which the stage in their country corresponds. Example: SPAIN – Educación Infantil y Primaria

DOCUMENTATION

https://www.genb-project.eu/

Compiling materials for educational and informational packages targeting Elementary school (T1.4 f2)

The educational and information package intended for teachers who teach young people in Elementary school consists of a total of six new materials. They are identified in Task 1.4 as follows:

- Task 1.4 b1: Educational board game
- Task 1.4 b3: Role play card game "BioHeroes: Let's save the planet!"
- Task 1.4 d: Video teasers and educational videos for 9-13 y.o.
- Task 1.4 j: Hands-on experiments
- Task 1.4 k: Fairy tale
- Task 1.4 l: Participatory photography

The following describes the Educational and information package for Elementary school (9-13 y.o.)

TITTLE OF THE ACTIVITY

The educational board game

SHORT DESCRIPTION

The educational board game is designed for young people and aimed at increasing their awareness and knowledge about the sustainable and circular bioeconomy and its applications, exploring the processes related to the production of bio-based products. A SUSTAINABLE bioeconomy aspires to be CIRCULAR by preserving resources for future generations and

promoting the use of waste from agriculture, forests, fishing and aquaculture, organic waste and industry by-products (such as food).

TIMES/TYPES/RESOURCES

TIME	LEARNING TYPE		TECHNOLOGY/MATERIALS
1 session of 50 minutes		*CREATE*	Materials available in the board game instructions and tool
	✓	*DEVELOP*	
	✓	*INVESTIGATE*	
	✓	*INTERACT*	
		PRESENT	
	✓	*EXPLORE*	

STEP 1	***Time: 1 session of 10 minutes***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***
SESSION 1 - Task 1: the teacher will carefully read the instructions to understand the game and explain it to the students.	SESSION 1 - Task 1: the students will read the instructions in groups to understand the game.	SESSION 1 - Task 1: assimilation of game concepts and mechanics.

STEP 2	***Time: 1 session of 40 minutes***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***
SESSION 2 - Task 2: the teacher will divide the classroom into groups of between 4 and 6 students. - Task 3: the teachers will carry out a first test game for the students to assimilate the game.	SESSION 2 - Task 2: once the instructions have been read, they will begin to separate the cards as indicated in the instructions and prepare to start the game.	SESSION 2 - Task 2: dynamization and interaction with the game, companions and their functioning.

STAGE

Students from 9 to 13 years old

LEVEL

Each partner must fill out this field with the educational level to which the stage in their country corresponds. Example: SPAIN – Educación Primaria y E.S.O.

DOCUMENTATION

https://www.genb-project.eu/

Role play card game "BioHeroes: Let's save the planet!"

TITTLE OF THE ACTIVITY

"BioHeroes: Let's save the planet!"

SHORT DESCRIPTION

Our world is under threat from imbalance: only the bioeconomy can save it! Fortunately, there are 6 bioeconomy professions that, if they manage to carry out all their tasks, can stop the destruction of the planet. The aim of the game is simple but crucial: be the first to help the bioeconomy professions fulfil their tasks and keep the Earth safe. The aim of the game is to complete the profession cards by placing three task cards on each of them. The player who completes the most profession cards is the winner.

TIMES/TYPES/RESOURCES

TIME	LEARNING TYPE		TECHNOLOGY/MATERIALS
1 session of 30 minutes		*CREATE*	Materials available in the board game instructions and tool.
	✓	*DEVELOP*	
		INVESTIGATE	
	✓	*INTERACT*	
		PRESENT	
		EXPLORE	

STEP 1	***Time: 1 session of 10 minutes***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***
SESSION 1 - Task 1: the teacher will carefully read the instructions to understand the game and explain it to the students.	SESSION 1 - Task 1: the students will read the instructions in groups to understand the game.	SESSION 1 - Task 1: assimilation of game concepts and mechanics.

STEP 1	*Time: 1 session of 20 minutes*	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***
SESSION 2 - Task 2: the teacher will divide the classroom into groups of 2 to 4 students. - Task 3: the teachers will carry out a first test game for the students to assimilate the game.	SESSION 2 - Task 2: once the instructions have been read, they will begin to separate the cards as indicated in the instructions and prepare to start the game. - Task 3: Play and enjoy the game!	SESSION 2 - Task 2: dynamization and interaction with the game, companions and their functioning.

STAGE

Students from 9 to 13 years old

LEVEL

Each partner must fill out this field with the educational level to which the stage in their country corresponds. Example: SPAIN – Educación Primaria y E.S.O.

DOCUMENTATION

https://www.genb-project.eu/

Video teasers and educational videos

TITTLE OF THE ACTIVITY

Video teasers and educational videos

SHORT DESCRIPTION

The use of videos is a powerful tool to capture interest and raise awareness about the circular bioeconomy, as these visual materials serve as effective means to convey and visualize practically complex concepts. By harnessing the power of storytelling and visual examples, GenB videos aim to captivate audiences, spark curiosity, and drive engagement in GenB.

TIMES/TYPES/RESOURCES

TIME	LEARNING TYPE		TECHNOLOGY/MATERIALS
1 session of X + 30 minutes		*CREATE*	Projector Computer/Tablet Internet connection
	✓	*DEVELOP*	
		INVESTIGATE	

	✓	*INTERACT*	
		PRESENT	
		EXPLORE	

Note: X minutes depends on the duration of the video teasers and educational videos

STEP 1	***Time: 1 session of X minutes***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***
SESSION 1 -Task 1: the teacher will prepare the videos for the students.	SESSION 1 -Task 1: students will watch the videos on bioeconomy.	SESSION 1 -Task 1: viewing videos and capturing concepts and aspects of the bioeconomy.

Note: X minutes depends on the duration of the video teasers and educational videos

STEP 2	***Time: 1 session of 30 minutes***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***
SESSION 2 -Task 2: the teacher will divide the classroom into various groups and assign them to watch the video again.	SESSION 2 - Task 2: students, in groups, will watch the video assigned by the teacher again and draw the main conclusions - Task 3: the groups will present the conclusions drawn from their video to the other students.	SESSION 2 -Task 2: presentation of ideas to the other members of the classroom.

STAGE

Students from 9 to 13 years old

LEVEL

Each partner must fill out this field with the educational level to which the stage in their country corresponds. Example: SPAIN – Educación Primaria y E.S.O.

DOCUMENTATION

https://www.genb-project.eu/

Hands-on experiments

TITTLE OF THE ACTIVITY

Hands-on experiments

SHORT DESCRIPTION

Practical experiments are a format used at GenB where young people actively participate in experiments with the aim of discovering many uses for bio-waste and seeing how it can be transformed into products. The practical experiments are aimed at young people of different age groups and can be used in formal, non-formal and informal educational settings.

TIMES/TYPES/RESOURCES

TIME	LEARNING TYPE		TECHNOLOGY/MATERIALS
1 session of 1 hour for each experiment	✓	*CREATE*	Templates with indications and instructions for the experiments, the list of materials and a brief explanation of the purpose of the workshop/experiment.
	✓	*DEVELOP*	
	✓	*INVESTIGATE*	
	✓	*INTERACT*	
	✓	*PRESENT*	
		EXPLORE	

STEP 1	***Time: 1 session of 1 hour***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***
SESSION 1 - Task 1: the teacher will explain to the students how to carry out some experiments on bioeconomy. - Task 2: the teacher will collect and provide the students with the materials necessary to carry out the experiments. - Task 3: the teacher will guide, accompany and offer all step-by-step instructions until the completion of the experiment.	SESSION 1 -Task 1: the students will pay attention to the experiment instructions. - Task 2: the students will inform the teachers about the use of objects and utensils that may be dangerous and will ask any questions they have.	SESSION 1 -Task 1: development of experiments to reinforce the practical activity on bioeconomy through a playful and enjoyable way.

STAGE

Students from 6 to 13 years old

LEVEL

Each partner must fill out this field with the educational level to which the stage in their country corresponds. Example: SPAIN – Educación Primaria y E.S.O.

DOCUMENTATION

https://www.genb-project.eu/

Fairy tale

TITTLE OF THE ACTIVITY

Fairy tale

SHORT DESCRIPTION

Fairy Tales is a tale aimed at children from 4 years of age, which aims to introduce the concepts of bioeconomy through storytelling. Storytelling is the most natural way to stimulate the curiosity and elicit learning in very young kids.

TIMES/TYPES/RESOURCES

TIME	LEARNING TYPE		TECHNOLOGY/MATERIALS
1 session of 30 minutes		*CREATE*	The material available will be the story in digital format. Projector Tablet/computer
		DEVELOP	
		INVESTIGATE	
	✓	*INTERACT*	
	✓	*PRESENT*	
		EXPLORE	

STEP 1	***Time: 1 session of 30 minutes***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***

SESSION 1 -Task 1: the teacher will present that they are going to read a story to introduce the concepts of bioeconomy. -Task 2: the teacher will ask the students to read the story to make them participate in the acquisition of knowledge.	SESSION 1 -Task 1: the students will read the story and write down or remember the concepts that were most important to them.	SESSION 1 -Task 1: interaction of students with reading and bioeconomy in a playful way.

STAGE

Students from 9 to 13 years old

LEVEL

Each partner must fill out this field with the educational level to which the stage in their country corresponds. Example: SPAIN – Educación Primaria y E.S.O.

DOCUMENTATION

https://www.genb-project.eu/

Participatory photography

TITTLE OF THE ACTIVITY

Participatory photography

SHORT DESCRIPTION

Through photographs (and/or video recordings), young people 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, through this format, young people (primary education classes) take photographs together with their families, who are actively involved as key players in lifelong learning.

TIMES/TYPES/RESOURCES

TIME	LEARNING TYPE		TECHNOLOGY/MATERIALS
1 session of 10 minutes 1 session	✓	*CREATE*	Mobile phone/Tablet Projector Computer
		DEVELOP	
		INVESTIGATE	
	✓	*INTERACT*	

of 20 minutes	✓	*PRESENT*	
	✓	*EXPLORE*	

STEP 1	***Time: 1 session of 10 minutes***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***
SESSION 1 -Task 1: the teacher explains to the students that they must take photos and videos about bioeconomy actions with their families and in everyday life.	SESSION 1 -Task 1: once the explanation is finished, the students will think and take the videos and photos in their homes and neighbourhoods.	SESSION 1 -Task 1: assimilation of tasks and interaction with aspects of the bioeconomy.

STEP 2	***Time: 1 session of 20 minutes***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***
SESSION 2 -Task 1: the teacher will recapitulate all the photos and videos sent by the students and will present them in class so that each student explains the context of their images and videos.	SESSION 2 -Task 1: the students explain, in turns, how they took the photos, where they took them and why they consider it to be an action related to the bioeconomy.	SESSION 2 -Task 1: presentation of images and interaction with other audiovisual materials of colleagues.

STAGE

Students from 9 to 13 years old

LEVEL

Each partner must fill out this field with the educational level to which the stage in their country corresponds. Example: SPAIN – Educación Primaria y E.S.O.

DOCUMENTATION

https://www.genb-project.eu/

The educational and information package intended for teachers who teach young people in High school consists of a total of six new materials. They are identified in Task 1.4 as follows:

- Task 1.4 b2: Educational game "Escape4Future - Chemistry meets circular economy"
- Task 1.4 b: Bioeconomy quizzes and educational cards for social media
- Task 1.4 d: Video teasers and educational videos for 14-19 y.o.
- Task 1.4 e: Online factsheets “bioeconomy job profiles”
- Task 1.4 k: Fairy tale
- Task 1.4 l: Participatory photography

The following describes the Educational and information package for High school (14-19 y.o.)

Educational game “Escape4Future – Chemistry meets circular economy”

TITTLE OF THE ACTIVITY

Educational game “Escape4Future – Chemistry meets circular economy”

SHORT DESCRIPTION

The “Escape4Future - Chemistry meets Circular Bioeconomy" engages students and parents in solving six interconnected enigmas that address green chemistry and bioeconomy issues through hands-on experiments or games. The objective is to find the way out to a more sustainable and circular lifestyle.

TIMES/TYPES/RESOURCES

TIME	LEARNING TYPE		TECHNOLOGY/MATERIALS
X	✓	*CREATE*	Materials available in the game tool.
		DEVELOP	
	✓	*INVESTIGATE*	
	✓	*INTERACT*	
		PRESENT	
	✓	*EXPLORE*	

Note: X minutes depends on the duration of the game.

STEP 1	***Time: 1 session of X minutes***	
Teacher’s role:	***Role of the students:***	***Type of interaction or educational activity:***

SESSION 1 - Task 1: the teacher will prepare all the riddles and puzzles of the game that the students will have to solve.	SESSION 1 - Task 1: The students were divided into groups and will complete all the puzzles presented in the game, so that they learn bioeconomy concepts.	SESSION 1 - Task 1: experience a learning game about economics using logic and puzzles to solve.

Note: X minutes depends on the duration of the game.

STAGE

Students from 14 to 19 years old

LEVEL

Each partner must fill out this field with the educational level to which the stage in their country corresponds. Example: SPAIN – E.S.O., Bachillerato y estudios universitarios

DOCUMENTATION

https://www.genb-project.eu/

Bioeconomy quizzes and educational cards for social media

TITTLE OF THE ACTIVITY

Bioeconomy quizzes and educational cards for social media

SHORT DESCRIPTION

"Biowiz: sustainable minds" is a bioeconomy quiz and flashcards that attempt to bring the basic concepts of bioeconomy to higher-level students in a more serious way, but through non-formal education. 10 questions and 10 educational sheets with data and precise definitions of aspects to reinforce what has been learned. Both the questionnaires and educational sheets focus on specific topics related to the bioeconomy, such as plastics, bioenergy, food and compost, renewable energy and employment, among others.

TIMES/TYPES/RESOURCES

TIME	LEARNING TYPE		TECHNOLOGY/MATERIALS
1 session of 1 hour		*CREATE*	The material provided with the questions and educational cards will be used to energize the classroom as if it were a quiz contest.
		DEVELOP	
	✓	*INVESTIGATE*	
	✓	*INTERACT*	
		PRESENT	

	✓	*EXPLORE*	

STEP 1	***Time: 1 session of 10 minutes***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***
SESSION 1 - Task 1: the teacher will divide the classroom into teams and a presenter of the contest - Task 2: the teacher will explain to the students that each group must respond in turn to the question posed by the presenter. If they get the question right they will be able to uncover an educational card on bioeconomy.	SESSION 1 - Task 1: the students will be divided into groups and will assume the role of team and/or presenter.	SESSION 1 - Task 1: assimilation of the concept of the contest.

STEP 2	***Time: 1 session of 50 minutes***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***
SESSION 2 - Task 1: the teacher will guide and help the students to develop the contest.	SESSION 2 - Task 1: the students answer the questions, in turn.	SESSION 2 - Task 1: The team that gets the most educational cards with information about bioeconomy is the winner.

STAGE

Students from 14 to 19 years old

LEVEL

Each partner must fill out this field with the educational level to which the stage in their country corresponds. Example: SPAIN – E.S.O., Bachillerato y estudios universitarios

DOCUMENTATION

https://www.genb-project.eu/

Video teasers and educational videos

TITTLE OF THE ACTIVITY

Video teasers and educational videos

SHORT DESCRIPTION

The use of videos is a powerful tool to capture interest and raise awareness about the circular bioeconomy, as these visual materials serve as effective means to convey and visualize practically complex concepts. By harnessing the power of storytelling and visual examples, GenB videos aim to captivate audiences, spark curiosity, and drive engagement in GenB.

TIMES/TYPES/RESOURCES

TIME	LEARNING TYPE		TECHNOLOGY/MATERIALS
1 session of X + 30 minutes		*CREATE*	Projector Computer/Tablet Internet connection
	✓	*DEVELOP*	
		INVESTIGATE	
	✓	*INTERACT*	
		PRESENT	
		EXPLORE	

Note: X minutes depends on the duration of the video teasers and educational videos

STEP 1	***Time: 1 session of X minutes***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***
SESSION 1 -Task 1: the teacher will prepare the videos for the students.	SESSION 1 -Task 1: students will watch the videos on bioeconomy.	SESSION 1 -Task 1: viewing videos and capturing concepts and aspects of the bioeconomy.

Note: X minutes depends on the duration of the video teasers and educational videos

STEP 2	***Time: 1 session of 30 minutes***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***

SESSION 2 -Task 2: the teacher will divide the classroom into various groups and assign them to watch the video again.	SESSION 2 - Task 2: students, in groups, will watch the video assigned by the teacher again and draw the main conclusions - Task 3: the groups will present the conclusions drawn from their video to the other students.	SESSION 2 -Task 2: presentation of ideas to the other members of the classroom.

STAGE

Students from 14 to 19 years old

LEVEL

Each partner must fill out this field with the educational level to which the stage in their country corresponds. Example: SPAIN – E.S.O., Bachillerato y estudios universitarios

DOCUMENTATION

https://www.genb-project.eu/

Online factsheets "Bioeconomy job profiles"

TITTLE OF THE ACTIVITY

Online factsheets "Bioeconomy job profiles"

SHORT DESCRIPTION

This activity aims to awaken the interest of young people in the different jobs that coexist in the bioeconomy. In this way, they will be able to discover aspects that they did not know and motivate them to learn concepts to develop and implement in the bioeconomy.

TIMES/TYPES/RESOURCES

TIME	LEARNING TYPE		TECHNOLOGY/MATERIALS
1 session of 1 hour	✓	*CREATE*	Sheets and templates on different work profiles in the bioeconomy will be used so that young people can learn, from experts in bioeconomy work, examples of profiles that are involved and perform functions in the bioeconomy. There will also be videos with real testimonies of these people answering questions of interest about the bioeconomy.
		DEVELOP	
	✓	*INVESTIGATE*	
		INTERACT	
		PRESENT	
	✓	*EXPLORE*	

STEP 1	*Time: 1 session of 10 minutes*	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***
SESSION 1 - Task 1: the teacher will explain the viewing of different videos of experts in bioeconomy.	SESSION 1 - Task 1: the students will watch the video in the classroom and review the transcription and the professional career of the expert in search of information that is relevant to them.	SESSION 1 - Task 1: assimilation and understanding of the videos and the different tasks and inspirations for bioeconomy work.

STAGE

Students from 14 to 19 years old

LEVEL

Each partner must fill out this field with the educational level to which the stage in their country corresponds. Example: SPAIN – E.S.O., Bachillerato y estudios universitarios

DOCUMENTATION

https://www.genb-project.eu/

Fairy tale

TITTLE OF THE ACTIVITY

Fairy tale

SHORT DESCRIPTION

Fairy Tales is a tale aimed at children from 4 years of age, which aims to introduce the concepts of bioeconomy through storytelling. Storytelling is the most natural way to stimulate the curiosity and elicit learning in very young kids.

TIMES/TYPES/RESOURCES

TIME	LEARNING TYPE		TECHNOLOGY/MATERIALS
1 session of 30 minutes		*CREATE*	The material available will be the story in digital format. Projector Tablet/computer
		DEVELOP	
		INVESTIGATE	
	✓	*INTERACT*	
	✓	*PRESENT*	

		EXPLORE	

STEP 1	***Time: 1 session of 30 minutes***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***
SESSION 1 -Task 1: the teacher will present that they are going to read a story to introduce the concepts of bioeconomy. -Task 2: the teacher will ask the students to read the story to make them participate in the acquisition of knowledge.	SESSION 1 -Task 1: the students will read the story and write down or remember the concepts that were most important to them.	SESSION 1 -Task 1: interaction of students with reading and bioeconomy in a playful way.

STAGE

Students from 14 to 19 years old

LEVEL

Each partner must fill out this field with the educational level to which the stage in their country corresponds. Example: SPAIN – E.S.O., Bachillerato y estudios universitarios

DOCUMENTATION

https://www.genb-project.eu/

Participatory photography

TITTLE OF THE ACTIVITY

Participatory photography

SHORT DESCRIPTION

Through photographs (and/or video recordings), young people 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, through this format, young people (primary education classes) take photographs together with their families, who are actively involved as key players in lifelong learning.

TIMES/TYPES/RESOURCES

TIME	LEARNING TYPE		TECHNOLOGY/MATERIALS
1 session of 10 minutes 1 session of 20 minutes	✓	*CREATE*	Mobile phone/Tablet Projector Computer
		DEVELOP	
		INVESTIGATE	
	✓	*INTERACT*	
	✓	*PRESENT*	
	✓	*EXPLORE*	

STEP 1	***Time: 1 session of 10 minutes***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***
SESSION 1 -Task 1: the teacher explains to the students that they must take photos and videos about bioeconomy actions with their families and in everyday life.	SESSION 1 -Task 1: once the explanation is finished, the students will think and take the videos and photos in their homes and neighbourhoods.	SESSION 1 -Task 1: assimilation of tasks and interaction with aspects of the bioeconomy.

STEP 2	***Time: 1 session of 20 minutes***	
Teacher's role:	***Role of the students:***	***Type of interaction or educational activity:***
SESSION 2 -Task 1: the teacher will recapitulate all the photos and videos sent by the students and will present them in class so that each student explains the context of their images and videos.	SESSION 2 -Task 1: the students explain, in turns, how they took the photos, where they took them and why they consider it to be an action related to the bioeconomy.	SESSION 2 -Task 1: presentation of images and interaction with other audiovisual materials of colleagues.

STAGE

Students from 14 to 19 years old

LEVEL

Each partner must fill out this field with the educational level to which the stage in their country corresponds. Example: SPAIN – E.S.O., Bachillerato y estudios universitarios

DOCUMENTATION

https://www.genb-project.eu/

Expected final outcomes

As of the date of delivery of this deliverable, the educational and information packages are being reviewed by the consortium partners. Similarly, the educational and information packages will be revised when all the GenB toolkit materials have been developed, in order to implement improvements. While the educational and information packages are composed of materials that have been and are being developed, a review of these is foreseen when the materials are finalised.

After implementing the changes detected, the translation into the 9 languages expressed in the DoA will be carried out. In parallel, the layout of each language will be carried out and uploaded to the project website. This material will be available in the D1.3 update in December 2024.

6.1.4 Language versions

The 9 language versions will be available on the GenB website at https://www.genb-project.eu/ by December 2024.

6.1.5 Conclusions

In summary, the development of this pedagogical toolkit has been a valuable process that has yielded important learnings. The need to adapt the content and educational level to the specificities of each national educational context has been observed, recognizing the differences in regulation and the particular needs of students. This adaptation will be considered in future iterations of the project to ensure greater relevance and usefulness in different educational environments.

Additionally, as a further improvement, the opportunity has been identified to provide more specific and concrete documentation links once they are available on the official GenB project website. This complementary measure will allow users to access additional resources and further enrich their learning experience.

6.2 Lesson plans (T1.4 g1)

6.2.1 Introduction

The content developed includes a lesson plan (LP1) focusing on the concept of bioeconomy designed for late elementary and early junior high school students (ages 9-13) aiming to introduce young learners to the idea of using biological resources to produce goods, services, and energy, emphasizing sustainability, renewable resources, and waste reduction. Through a combination of discussions, activities, AI tools, and interactive games, the lesson plan seeks to make complex topics accessible and engaging for young students. It includes an introduction to bioeconomy, group activities to identify renewable resources and bio-based products, discussions on sustainability, and a creative assignment, all structured to foster an

understanding of bioeconomy's significance in a way that's relatable and interesting to this age group.

6.2.2 Methodological approach

The development of the educational toolkit tailored for elementary school teachers (LP1), involves a methodological approach designed to produce resources that are both educational and engaging for young learners. This methodology focuses on creating a comprehensive and pedagogically sound toolkit that supports elementary school teachers in delivering effective bioeconomy and sustainability education. The methodological phases include:

- Identification of the specific educational needs and curriculum standards for the target group age students regarding sustainability and bioeconomy.
- Establishment of a structured educational framework defining key learning objectives, content themes, and pedagogical approaches suitable for elementary learners.
- Development of specific teaching materials that cover the fundamentals of the bioeconomy and its importance for sustainability, that are engaging, informative, and interactive. Use of AI and easy-to-use multimedia tools specifically tailored for young children.
- Pilot testing of the toolkit in a real classroom setting to assess its effectiveness and gather feedback from students, and consequent revision and improvement of the content based on feedback and test results. (*Note: This phase is pending, and is to be implemented during May 2024, however the educational tools and approaches included in the toolkit have been individually tested and successfully implemented by the bioeconomy teaching expert who contributed to the development of the lesson plan).*

The tools and resources used for the development of the toolkit include the use of online repositories (i.e. the GenB Online Library, FEE online resources on Eco-Schools) and materials available from previous projects (e.g. Transition2Bio materials), review of existing educational formats, backward designing to ensure educational objectives are met, the use of child-friendly multimedia resources and AI tools (YouTube, Kahoot!, Wordwall, ChatterPix Kids and ChatGPT) as well as educational formats and instruction resources such as KWL charts, worksheets, graphics, quizzes and exit tickets for reflection and feedback. The materials were developed with the contribution of Marianthi Giannakopoulou, English teacher at the “Bodossaki” Elementary School of the Athens College and an expert at teaching Bioeconomy to elementary school students as well as implemementing environmental education programmes, including “Eco-Schools”, “Learning About Forests” and “Young Reporters for the Environment” by FEE. The material was additionally reviewed by Maria Chatzinikolaou, expert in Environmental Education, and Dr. Xanthi Chantzistrountsiou, Biologist and teacher of positive sciences in primary and secondary education in the private sector.

6.2.3 Developed materials

Lesson plan 1

The toolkit includes a set of resources, necessary for the successful implementation of the lesson plans, instructions as well as resources and media needed, in the following files:

- "Lesson Plan 1": Description and instructions for two 45-minute teaching periods
- "KWL Chart": graphical organizer that helps students reflect on their learning process by organizing information into three columns labelled "K" (What I Know), "W" (What I Want to know), and "L" (What I Learned)
- "Project Video Sample Chatterpix": sample video of class project, a talking image of a bio-based diaper
- "Brainstorm on Bioeconomy-ECO Schools Plan": a brainstorm chart on the 7 steps of Eco-Schools to be linked with bioeconomy
- "ECO-CODE & BIOECONOMY": eco-code ideas and example of ECO-CODE linked to bioeconomy (nursery song: The song of Bioeconomy)
- "Reflection Worksheet": worksheet including a matching activity, two tables (one for students and one for teachers for the "three checks-one cross" handout) and an exit ticket
- "Bioeconomy Lesson Plan Elementary School": an example presentation created at Slidesgo.
- All files include links to the necessary online resources (videos, apps, games) for the lesson implementation.
- Visuals": visual examples of bio-based products and resources and a table for students to draw their own examples
- "BIOECONOMY PROJECT _RESOURCE DON'T GO- MAGAZINE" powerpoint slide show of a school project example

These lessons aim at developing informed, responsible, and proactive citizens who are equipped to contribute to a sustainable future. Upon completing this lesson, students are expected to:

- have a basic understanding of what the bioeconomy is, including its significance in promoting sustainability
- identify examples of bio-based products in their daily lives
- develop critical thinking and problem-solving skills as they brainstorm practical ways to apply bioeconomy principles in their everyday lives
- be motivated to participate actively in sustainability efforts, like making more environmentally friendly choices
- learn how to work in groups
- be able to reflect on their current knowledge, their learning process, and the practical applications of what they've learned
- be inspired to further explore the topics related to bioeconomy, sustainability and environmental awareness.

Expected final outcomes

In order to ensure that the final toolkit is not only theoretically sound but also practically effective, engaging, and user-friendly, and to maximizing its educational impact upon full release, the developers feel that it is essential to include an extra piloting phase in a real classroom setting. This process will facilitate the assessment of the real-world effectiveness of the toolkit. Despite theoretical planning and design, it is crucial to see how the materials perform

in the classroom, where variables like student engagement, comprehension levels, and classroom dynamics come into play. Furthermore, the practical, first-hand feedback on the usability and relevance of the toolkit and the integration of the material into existing curricula will allow developers to identify areas for improvement that may not have been apparent during the design and development stages. Feedback can reveal oversights, misconceptions, or additional needs that might have not been previously considered. Marianthi Giannakopoulou (English teacher at the "Bodossaki" elementary school of the Athens College) will pilot the lesson during May 2024. The toolkit will be revised according to the feedback gathered and finalised by the end of May 2024.

6.2.4 Language versions

The 9 language versions will be available on the GenB website at https://www.genb-project.eu/ by December 2024.

6.2.5 Conclusions

The development and implementation of educational plans focusing on the bioeconomy and sustainability underscore important insights. Cross-disciplinary integration enriches learning by showing the interconnectedness of various fields, while engaging learners through interactive and hands-on activities enhances understanding and encourages real-world application. Utilizing real-world examples brings abstract concepts to life, demonstrating their practical importance. Flexibility in adapting educational content based on feedback ensures effectiveness and piloting these tools in a real-life classroom provides an extra validation step to ensure these strategies are not only great in theory but also practically applicable. Sustainability education is an ongoing journey, requiring continuous adaptation and learning to stay relevant and impactful. In conclusion, dynamic and inclusive educational strategies are vital in promoting a sustainable future.

6.3 Training contents (T1.4 h)

The training materials designed to complement the Lesson Plan and MOOC will be structured as a series of seven concise presentations, each comprising up to 20 slides. These presentations will each focus on one of the seven steps of the "Eco-Schools" Programme by the Foundation for Environmental Education. They will provide detailed descriptions and explanations of each step, linking them explicitly to bioeconomy concepts. Additionally, the presentations will offer practical examples and suggestions to aid educators in effectively implementing these steps within the context of the bioeconomy. This approach ensures a comprehensive resource that not only educates but also facilitates practical application in educational settings. The presentations are currently in drafting process. In order to ensure that all the information is current and in line with FEE's "Eco-Schools" standards the drafting process was extended to accommodate for thorough research on new formats and developments following the "Eco-Schools" awarding ceremony in Greece as well as a series of other events held in the context of FEE environmental education programmes. Additionally, the materials will be reviewed and validated by FEE before they are sent to the GenB partners for peer review. The materials are expected to be finalized by the end of May to early June so they can be subsequently

incorporated in the MOOC. The 9 language versions will be available on the GenB website at https://www.genb-project.eu/ by December 2024.

6.4 MOOC (T1.4 i)

6.4.1 Introduction

The Massive Open Online Course (MOOC) is a high-quality free training course curated for teachers and educators from various educational settings and levels. Developed in collaboration with Scientix, the MOOC will aim to equip and train teachers of all target groups within the project, from all over Europe and beyond, with comprehensive knowledge and practical tools for integrating bioeconomy concepts into their teaching practices. While the focus of the MOOC is on educators within the project's scope, other educators from various educational settings are welcome to participate in the MOOC and tailor the training course/information to their educational settings.

The MOOC focuses on maximizing the use of contents and innovative approaches developed within Work Package 1 and 2, through tailored activities addressing each of the target group teachers. Each module will address general methodologies and approaches for effectively teaching bioeconomy in school environments. In addition, learning materials addressing educators at different educational levels, ensuring inclusivity and accessibility across the educational spectrum.

6.4.2 Methodological approach

The MOOC will take place from the 14th of October to the 20th of November 2024 for a period of 5.5 weeks in EUN Academy's platform and will consist of 4 Modules. Each module would open at the beginning of the week and remain open even after the certification period (5.5 weeks) of the MOOC. Participants will be able to go to go back to each module according to their time and needs for the whole duration of the certification period, as well as after the MOOC is archived. Participants are expected to dedicate a total of up to 25 hours to finish the course, with each module demanding approximately 5 hours of engagement. The modules will focus on:

- Module 1 will focus on the basic concepts of bioeconomy (e.g. linear and circular economy, biomass, bio-based materials and solutions, SDGs), as well as its presence in everyday life and at school settings, covering the topics such as controversial aspects of bioeconomy (e.g. greenwashing), building of sustainable habits.
- Module 2 will introduce activities, aimed at presenting different uses of bioeconomy materials, 7 Step Eco-School methodology and the GenB Toolkit to empower teachers and educators in their classrooms. The module will include practical examples and materials developed within WP1 and 2, for example lesson plans, educational cards and quizzes, living labs, hands-on experiments and more. As part of Module 2 participants will have a chance to participate in a webinar session on a selected topic in the field of bioeconomy.
- Module 3 will aim to help participants understand the skills and expertise required in the field of bioeconomy and raise awareness that will ultimately inform students for the various career opportunities in this field. The module will include the description of what

are the bioeconomy job sectors, required skills and knowledge to work in the field, as well as practical materials for teachers, such as bioeconomy job profiles and career factsheets, to help them most effectively introduce the potential careers in bioeconomy.

- Module 4 will explore ways in which participants can better define learning objectives, propose ways to use and apply the different materials presented within the MOOC as effectively as possible and select appropriate assessment methods for their students. As a final product of the MOOC, participants will prepare a Bioeconomy Learning Scenario, focusing on effective use of learning materials and activities presented within the course. As part of this module participants will have a chance to participate in a TeachMeet, a collaborative, co-creation session where teachers share the draft of their Bioeconomy Learning Scenario in order to obtain feedback and share ideas with their peers.

In this course, participants will be introduced to the concepts of bioeconomy and circular bioeconomy, as well as the role that bioeconomy plays in everyday life. In addition, they will be provided with practical examples which illustrate how bioeconomy can be introduced in different subjects and educational settings. This will allow teachers to create more student-centered, innovative, and adaptable learning experiences, while fostering problem-solving skills and a culture of continuous improvement. During the course, participants will have a chance to discover the jobs of the future in this field, and essential 21st century skills required to become a bioeconomy expert. Lastly, participants will construct their own resources on how to implement the topic most effectively in their educational settings.

The MOOC content will include the knowledge and existing materials developed within the BLOOM MOOC, Transition2BIO online courses, modules of the capacity building webinars for GenB Ambassadors. In addition, throughout the course, participants will be presented with a compilation of materials and resources developed within the project and the GenB Toolkit for teachers of all target groups, such as lesson plans, educational games, cards and quizzes, job profiles and more. The MOOC participants will, also, be introduced to the 7-Steps of Eco-Schools Methodology, a series of measures to guide the schools in becoming more environmentally sustainable, while involving the whole school community in the process.

The MOOC, will incorporate traditional materials like lectures and readings, coupled with interactive elements such as user forums and social media discussions focusing on making the resources created through the various objectives accessible within Work Package 1 and 2. Participants of the MOOC will be supported through the process by expert teachers who will provide guidance and moderate the course. Additionally, teachers will also provide with a community space where they could share their experiences, challenges and insights about the topic, as well as form collaborations and cooperate in different activities. The channels will include a dedicated course Facebook group and X, using the dedicated course hashtag and the course forum.

By the end of the course, participants will be able to:

- Familiarise themselves and gain deeper understanding of various concepts that are central in the field of Bioeconomy.

- Identify bioeconomy's significance in everyday life and classroom practices.
- Know what the GenB project is, and how it can help innovate their classroom practices.
- Discover and navigate innovative ways of engaging students in the learning process through a methodical exploration of GenB toolkits.
- Gain awareness about the required skills and career opportunities in the field of bioeconomy and facilitate students towards developing necessary skills and knowledge to engage in such careers.
- Learn to design and implement bioeconomy related activities within the school, aiming at helping students deepen their understanding of bioeconomy, through the analysis of best practices and collaboration with peers.
- Engage in a collaborative learning experience with your peers and co-develop a Bioeconomy Learning Scenario applying the skills and knowledge gained through the course.

Participants will get a certification proving their acquired knowledge after completing the designated assignments, developing a Bioeconomy Learning Scenario as a final assessment, and engaging in peer assessments within the course.

The MOOC will run on the EUN Academy (EUNA) Platform that primarily offers massive open online courses (MOOCs), which are entirely free of charge and open for anyone to join, with no limit to the number of participants. This focus on openness, and the pedagogical approach of the EUNA is based on the need to cost-effectively maximize the scale and inclusivity of professional development offers to teachers, providing them with an opportunity to be self-reflective practitioners, willing to interact with peers and with a high level of self-efficacy. In addition, the EUNA approach is based on the premise that successful professional development encourages the development of learning communities where teachers share their expertise.

The MOOC will remain available on the EUNA platform and partners may host the MOOC on their available platforms and GenB website. The MOOC and all the materials included in the MOOC will be prepared in English. However, partners may translate the course material or part of it in their national languages.

6.4.3 Developed materials

The MOOC content will include the state of art knowledge and publicly available materials developed within different bioeconomy related courses, such as BLOOM MOOCs and Transitio2Bio courses, modules of the capacity building webinars for GenB Ambassadors and other materials already developed within the GenB project. Presented materials would include resources as lessons plan, how to implement 7 Step Eco-Schools methodology, educational games, cards, factsheets and quizzes, bioeconomy job profiles and more. The MOOC, will also incorporate traditional materials like lectures and readings, coupled with interactive elements such as user forums and social media discussions focusing on making the resources created through the various objectives accessible within WP1 and WP2. A provisional list of potential publicly available materials, specifying they may be included, can be found in the Table 9 below. It is important to note that additional materials, developed within the project for internal use, will be used as a basis of the course and will also be showcased within the course.

Name of the material	Module	Link
BLOOM MOOC: Boosting bioeconomy knowledge in schools	1-3	https://bloom-bioeconomy.eu/mooc/
Transition2BIO MOOC teachers' training	1-2	https://www.transition2bio.eu/teacher-training/
Introduction to the bioeconomy PPT	1	Internally developed material, GenB SharePoint
Lesson plans for teachers as part of the GenB Toolkit	1-3	Internally developed material, GenB SharePoint; To be published
7-Steps of Eco-Schools Lesson Plans, including 7 Presentations, as part of the GenB Toolkit	1-3	Internally developed material, GenB SharePoint; To be published
Bio-based products PPT	1	Internally developed material, GenB SharePoint
Bioeconomy and challenges PPT	1	Internally developed material, GenB SharePoint
Bioeconomy and controversial topics PPT	1	Internally developed material, GenB SharePoint
What is bioeconomy Gamified book as part of the GenB Toolkit	1-3	https://library.genb-project.eu/VLToolkit?id=a030900000TStfcAAD
MOOC for primary teachers	2	Internally developed material, GenB SharePoint
BLOOM School Box	2	https://bloom-bioeconomy.eu/schoolnetwork/schoolbox/

Name of the material	Module	Link
Transition2Bio Toolkit for teachers	1-3	https://transition2bio.eu/wp-content/uploads/2023/01/02.Transition2Bio_Toolkit_Teachers_3.pdf
Bioeconomy for schools PPT	2	Internally developed material, GenB SharePoint
GenB/TransitiontoBio Toolkit	2	Internally developed material, GenB SharePoint
GenB Living Lab	2	Internally developed material, GenB SharePoint
Transition2Bio Materials	2	https://www.transition2bio.eu/games/
Interviews to young bioeconomy entrepreneurs	3	https://www.youtube.com/watch?v=b1lhgscvFdo&list=PLbA125z357wRCKgsNBP8Yskd4kR33MJPO
GenB Bioeconomy Job Profiles	3	https://www.genb-project.eu/resources/bioeconomy-job-profiles/
Biorefinery visits	3	Internally developed material, GenB SharePoint
Career Info-days recording	3	Internally developed material, GenB SharePoint
GenB BioHeroes: Let's save the planet! Role-play card game	3	To be published
AllThings.BioPro. Jobs and Careers in bioeconomy Factsheet	3	https://library.genb-project.eu/VLToolkit?id=a030900000TSPuCAAX
UrBIOfuture. Why should you pursue a career in bioeconomy?	3	https://www.youtube.com/watch?v=oIlSL9-t2cE
Bioeconomy Quizzes and online games	1-3	https://library.genb-project.eu/VLHome

Name of the material	Module	Link
as part of the GenB Toolkit		
Capacity Building modules for GenB Ambassadors	1-3	Internally developed material, GenB SharePoint

Table 9. Potential publicly available materials for the MOOC

Note: All the links to materials that are currently available only on the GenB Consortium SharePoint will be available in the next version of the report.

Expected final outcomes

The outcome of the GenB 'What is bioeconomy' MOOC is to deepen educators' understanding of bioeconomy concepts while equipping them with practical skills to integrate these principles into their teaching practices. Moreover, teachers will be provided with an opportunity to gain insights into the complexities of bioeconomy as a field, including its interdisciplinary nature and significance for sustainable development. In addition, teachers will learn about of the required skills and career opportunities in the field of bioeconomy and facilitate students towards developing necessary competencies and knowledge to engage in such careers. They will learn innovative teaching approaches tailored to effectively communicate bioeconomy concepts to students, fostering critical thinking and problem-solving skills. The course also provides opportunities for networking and collaboration among educators, enabling the exchange of ideas and best practices in bioeconomy education. Participating teachers should become empowered to engage students in meaningful discussions and activities that address contemporary issues related to bioeconomy, thus contributing to improved student learning outcomes and societal awareness.

When we reflect on the project KPIs, the expected outcome of the MOOC related activities is the participation of approximately 800 teachers, from around Europe and beyond, with an indirect impact on 12,000 students.

6.4.4 Language versions

The MOOC will be hosted in English on the EUN Academy platform. Partners are permitted to translate specific materials, content, or modules of the MOOC for utilization in their national teacher training activities.

6.4.5 Conclusions

The MOOC is in the development phase and will take place in October 2024. The deviation from GA is due to its link to part of the materials developed in the Toolkit, which are also under development and will be available by the time this deliverable is submitted. It is important to note that some of the content and materials are already available and are being considered in

the development process (i.e. content developed for the GenB Ambassadors capacity building, etc.).

6.5 Hands-on experiments (T1.4 j)

See section 3.4

6.6 Fairy Tale

See section 3.5

6.7 Participatory photography (T1.4l)

See section 3.5

6.8 Podcasts (T1.4 m)

See section 3.7

7 Toolkit for multipliers

The toolkit for multipliers consists of a total of one new material. It is identified in Task 1.4 as follows:

- Task 1.4 g2: Lesson plans (LP2)
- Task 1.4 h: Training contents
- Task 1.4 j: Hands-on experiments
- Task 1.4 k: Fairy tale
- Task 1.4 l: Participatory photography
- Task 1.4 m: Podcasts

This tasks are described sequentially in the following sub-sections.

7.1 Lesson plans (T1.4 g2)

7.1.1 Introduction

The content developed includes a lesson plan (LP2) for general public multipliers, such as unofficial 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. Aiming to familiarize an intergenerational audience to the basic bioeconomy principles, 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 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.

7.1.2 Methodological approach

The development of the educational toolkit addressed to general public multipliers (LP2) involves a structured methodology aimed at creating accessible, engaging, and informative content that can educate and resonate a wide variety of receivers with diverse background of knowledge on bioeconomy. This process is tailored to meet the diverse needs of a broad audience, including educators, community leaders, parents and interested individuals. It emphasizes 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 methodological phases include:

- Definition of the scope and objectives of the toolkit based on the needs and interests of the general public regarding the topic and the realisation of relevant research
- Planning, design and development of a comprehensive educational framework that outlines key topics, learning objectives, and formats for delivering the content

- Creation of content including a variety of educational materials, such as presentations, guides, activities, and digital content, addressing a general audience.

The tools and resources used for the development of the toolkits include the use of online repositories (i.e. the GenB Online Library, FEE online resources on Eco-Schools) and materials available from previous projects (e.g. Transition2Bio materials), review of existing educational formats, backward designing to ensure educational objectives are met, the use interactive multimedia tools (such as videos) as well as educational formats and instruction resources such as worksheets, graphics, question cards, quizzes and exit tickets for reflection and feedback. The materials were developed with the contribution of Marianthi Giannakopoulou, English teacher at the "Bodossaki" Elementary School of the Athens College and an expert at teaching Bioeconomy to elementary school students and the implementation of environmental education programmes, including "Eco-Schools", "Learning About Forests" and "Young Reporters for the Environment" by FEE. The material was additionally reviewed by Maria Chatzinikolaou, expert in Environmental Education, and Dr. Xanthi Chantzistrountsiou, Biologist and teacher of positive sciences in primary and secondary education in the private sector.

7.1.3 Developed materials

Lesson plan 2

The toolkit includes a set of resources, necessary for the successful implementation of the lesson plan, instructions, as well as online resources and media needed in the following files:

- "Lesson Plan 2": Description and instructions for two 2-hour teaching periods
- "Question cards-answer cards": a set of cards with questions and answers for an experiential learning session
- "Benefits vs Challenges": a pros-and-cons type of chart and a table of clue cards that can be used either virtually or physically (by cutting the cards and sticking them to the chart)
- "Assessment-Multiple choice": a multiple-choice quiz
- "REFLECTION WORKSHEET FOR MULTIPLIERS": worksheet including a matching activity, two tables (one for students and one for teachers for the "three checks-one cross" handout) and an exit ticket
- "Activity -Introduction Bioeconomy Concept": image and text explaining the bioeconomy concept in everyday life

All files include links to the necessary online resources (videos, apps, games) for the lesson implementation.

Expected final outcomes

The lesson aims to empower participants to educate and inspire others, thereby expanding the reach and impact of sustainability and bioeconomy awareness. Upon completing this lesson, individuals are expected to:

- have a comprehensive knowledge of the bioeconomy, including its principles, the role it plays in sustainability, and its potential to address environmental challenges

- become aware of how the bioeconomy impacts various sectors, and learn about real-world applications and success stories
- be equipped with knowledge and resources and be prepared to effectively communicate and advocate for the principles of the bioeconomy within their communities
- be able to use strategies and tools to engage others in discussions about sustainability and the bioeconomy
- be inspired and motivated to become active proponents of bioeconomy initiatives and to consider how they can contribute to a sustainable future in their personal and professional lives
- be encouraged to develop a network to share ideas, challenges, and successes, thereby building a supportive community of practice focused on promoting the bioeconomy
- develop critical thinking skills about current economic systems and environmental issues, encouraging innovative thinking about solutions and alternatives offered by the bioeconomy.

This Lesson Plan will not be piloted so when peer review is over it can be delivered as is.

7.1.4 Language versions

This material will be translated into 9 languages and it will be available in the GenB project website at https://www.genb-project.eu/

7.1.5 Conclusions

The creation of educational programs on topics like the bioeconomy and sustainability is quite complex and it is important to employ thoughtful planning, engagement, adaptability, and a commitment to continuous learning. Some of the lessons learned during this process include:

- #1 The importance of an interdisciplinary educational approach, since the bioeconomy intersects with various fields (e.g. biology, economics, environmental science, technology). Integrating these perspectives creates a more comprehensive and engaging learning experience but also requires careful planning to ensure the content remains accessible to all audiences.
- #2 Incorporating case studies, success stories and real-world examples of bioeconomy in action helps to ground theoretical concepts, making the learning experience more relevant and impactful for participants.
- #3 Interactive and participatory learning activities are crucial for engaging diverse audiences, and incorporating a variety of teaching methods, including discussions, hands-on activities, and group projects, to cater to different learning styles and preferences is essential.
- #4 Simplifying complex concepts without oversimplifying them is a fine balance. Effective communication involves clear language, engaging visuals, and relatable examples, ensuring that participants not only understand the concepts but can also explain them to others.

7.2 Training contents (T1.4 h)

The training content developed for teachers is replicable and suitable for multipliers as well. See section 6.3.

7.3 Hands-on experiments (T1.4 j)

See section 3.4

7.4 Fairy Tale

See section 3.5

7.5 Participatory photography (T1.4l)

See section 3.5

7.6 Podcasts (T1.4 m)

See section 3.7

8 Toolkit for boosting collaboration

The toolkit for boosting collaboration among several stakeholders consists of a total of one new materials. It is identified in Task 1.4 as follows:

- Task 1.4 n: Contest “The (shitty) Golden Ticket”

This task is described sequentially in the following sub-section.

8.1 Contest ‘The (shitty) Golden Ticket’ (T1.4 n)

8.1.1 Introduction

The tools and activities developed so far in the project are aimed at achieving the objective of improving understanding and awareness of bioeconomy concepts among young people, teachers, multipliers and other stakeholders. However, the project identifies the need to develop actions that are aimed at fostering collaboration between these different stakeholders.

The toolkit for boosting collaboration is built on the premise of developing dynamics where the tools offered by the GenB toolkit and the tools contained in the GenB Library are put into practice.

This chapter presents the fostering of collaboration through contests. To make the tool ‘quizzes and educational cards’ more attractive, it has been integrated into a contest that includes a motivational narrative.

The (shitty) Golden Ticket is a competition where participants compete to win a unique golden ticket. To do so, they have to collect 6 reward tokens, which they get by answering the questions in each token theme. Once collected, they will face the final question in the bio refinery, with which they can win the golden ticket.

This fun and light-hearted proposal is in line with one of the trends that is still present in the toy and gaming sector: It is called ‘Just for fun’ and was presented at the Spielwarenmesse, the most important European toy fair in 2017. This trend revolves around the concept of playing for the sake of playing, without pursuing any learning objectives. Within the framework of this trend, numerous games with a scatological theme have been developed and launched on the market (e.g. Don't step in it! by Hasbro games and Flushin Frenzy by Mattel games, among others). A scatological theme in the game can arouse the interest of various stakeholders due to its unexpected and often humorous nature. This strategy also makes this contest stand out from other similar offerings, which increases its appeal and visibility to a wider audience.

To foster synergies, it is proposed to organise ‘Youth versus Adults’ competitions. In school context, this dynamic could be called ‘Students versus Teachers’, while in informal educational context or at home, it could be implemented as ‘Children versus Parents’.

Participation in contests and competitions fosters collaboration by creating an environment in which participants must work together to achieve a common goal. Healthy competition promotes teamwork, as participants support each other and motivate each other to achieve

collective success. It also promotes collaborative learning and the development of interpersonal skills, preparing participants to work effectively in teams in a variety of contexts.

The contest events can be carried out in a variety of contexts, including formal and informal educational environments and awareness campaigns. In addition to the above-mentioned contexts, workshops can also be held in play centres, libraries, cultural centres and educational events or conferences related to the bioeconomy. These workshops can be organised e.g. by educational organisations, NGOs, governmental institutions or companies committed to promoting awareness of the bioeconomy.

8.1.2 Methodological approach

The methodology followed to develop the competition consisted of several stages. First, initial research was carried out to define the theme, format and rules of the competition. Subsequently, the location of the resources created outside the framework of the project and collected in the GenB Library was located.

The structure of the contest was designed, determining the number of rounds, the scoring system and possible challenges or wildcards that could be added to increase excitement and interaction between participants.

This was followed by an internal testing phase to validate the functioning of the contest, assessing the appropriateness of the rules and the overall smoothness of the game. During this phase, feedback was collected and adjustments were made. Three experts from AIJU participated in the contest design process. Their expertise is shown in Table 10.

Expert	Name of the expert	Expertise
1	Ana Mata-Dominguez	Toy market analyst, User insights
2	Pablo Busó-Alós	Toy market analyst, User insights
3	Clara Blasco-López	Design & Trend research, Toy design, User insights

Table 10. Experts participating in The (Shitty) Golden Ticket design

Finally, the implementation of the contest was carried out, preparing all the necessary materials, selecting the presenter or moderator and coordinating the logistics for its execution. During the event, the development of the contest was monitored and notes were taken on any aspects that could be improved in future editions.

8.1.3 Developed materials

General objective

Facilitate a competition that encourages collaboration between different stakeholders (young people, teachers and multipliers) to promote environmental awareness, understanding of the bioeconomy through 'game-based learning' methodologies.

Specific objectives

1. Improve understanding and awareness of the bioeconomy. Educate participants on the importance of addressing today's environmental challenges, the interconnection

between the economy and the environment and promote awareness of the need to adopt sustainable practices.

2. Stimulate interest and curiosity in the bioeconomy. Competitions can motivate participants to delve deeper into the topic.
3. Promote active learning. Quizzes encourage active participation of participants, which helps them retain and better understand the information.
4. Strengthen parent-child and teacher-student relationships. These activities promote interaction and teamwork between parents and children and between teachers and pupils, strengthening family ties and teacher-pupil relationships.
5. Developing cognitive skills. Participating in competitions involves problem solving, rapid decision making and critical thinking, which contributes to the development of cognitive skills such as logical reasoning and informed decision making.
6. Encourage communication and teamwork. These activities promote effective communication among team members, as well as teamwork and collaboration to achieve a common goal.
7. Build self-esteem and confidence. Competitions provide an opportunity to demonstrate knowledge and skills, which can increase the self-esteem and confidence of participants, both children and adults.

Resources

GenB toolkit quizzes[25] (T1.4 c) and GenB Library quizzes[26].

Note: The target audience participating in the competition is the key factor to select the set of quizzes. This approach takes into account the needs, abilities and levels of understanding of the participants, allowing the format, the difficulty of the challenges posed and the activities proposed to be adapted according to each age group. By adapting the quizzes to the specific ages of the participants ensures not only an enriching and relevant experience but also the achievement of the objectives.

Target audience

Table 11 shows the target audience and the benefits of implementation.

Target audience	Benefits
Pre- and Early-school students (4-8 y.o)	It offers the opportunity to learn in a gamified way. It promotes the development of cognitive skills such as problem solving, decision making and critical thinking, as well as fostering curiosity and interest in science and technology. They can also increase children's self-esteem and confidence by allowing them to demonstrate their knowledge and skills in a competitive but safe environment.
Elementary school students (9-13 y.o.)	
High school students	

[25] https://www.genb-project.eu/resources/toolkits/bioeconomy-quiz/)
[26] https://library.genb-project.eu/VLTeachers

Target audience	Benefits
(14-19 y.o.)	
Teachers	It provides a mechanism for updating their knowledge in the field of bioeconomics, increasing their commitment to teaching and increasing their professional recognition. It strengthens the relationship with students and promotes a collaborative and mutual learning environment between teachers and students.
Multipliers: parents and relatives	It allows parents to be actively involved in their children's education and development by learning together, promoting communication, teamwork and bonding. It also provides them with the opportunity to model positive behaviours towards learning and exploring new topics.

Table 11. Target audience and its benefits

Game rules

The (shitty) Golden Ticket
The craziest bioeconomy quiz contest for all ages!

The (shitty) Golden Ticket is a GBL contest for boosting collaboration among young people, teachers and multipliers aimed at enhancing their awareness and knowledge of bioeconomy and its applications, while exploring various topics within this concept.

Participants compete to win a unique golden ticket. What is remarkable about this ticket is its peculiar origin, as it has been made from animal excrement in the framework of the bioeocnomy. As well as being innovative and creative, this initiative aims to raise awareness of the importance of finding sustainable ways of using available resources. Through this competition, it aims to highlight how even seemingly unusual materials can be transformed into valuable and unique objects through innovation and creativity.

Contents

- 100 Question and answer Cards
- 20 Educational Cards
- 1 Thematic Dice
- 1 Challenge Dice
- 6 Reward Tokens (for each participating team)
- 10 Joker Reward Tokens
- 1 Golden Ticket

Aim of the game

To be the first to get the (shitty) Golden Ticket.

Type of the contents

They are described in Table 12.

Content	Description
Question and answer Cards	The cards contain the questions and answers. The questions on the cards can have multiple choices or be true/false.
Educational Cards	These are cards that expand on the questions posed in the question cards. Not all question and answer cards will have an associated educational card. A group of question and answer cards will share an educational card.
Thematic Dice	Each side of the die represents a theme, to be decided according to the quizzes and educational card resource available to the target audience. Each side of the die is colour coded.
Challenge Dice	Challenge Dice introduces dynamics that can alter the game to either aid a team in winning or prevent opponents from claiming a Reward Token before you. Use them strategically to your advantage. Each side of the die represents a challenge: • Versus: The team selects another team to play against. The first to answer correctly wins the reward token. • Thief: If the team does not answer correctly, they lose a reward token. If they have none, they are not affected. • 50%: Only half the team can participate in answering the question. • Joker: The team chooses the category of the question using the Theme Dice. If they answer correctly, they earn 1 Joker Reward Token. • Missed turn: The team loses its turn. A maximum of three turns can be skipped per team per game. • Teamwork: The team selects an opposing team to answer the question together. In case of a correct answer, both teams win a Reward Token.
Reward Tokens	These are the tokens you get for answering a question correctly. There are 6 different colours, one for each of the themes of the thematic dice.
Joker Reward Tokens	These are tokens that are obtained by correctly answering a question on a topic that has already been passed. Their colour is neutral. When three jokers are accumulated, they are exchanged for the desired Reward Token.
Golden Ticket	It is the prize the team wins.

Table 12. Type of the contents in The Shitty Golden Ticket contest

Setting up the game

See sub section 'Session script'

How to play

The game is played clockwise. The starting team is the team with the youngest participant. Each turn consists of:

1. Roll the two dice.
2. Perform the required actions.
3. Answer the question asked. Only the team whose turn it is responds.
4. If successful, receives a thematic reward card. On a failure, take the action required by the challenge die (if applicable).

After that, it is the next team's turn.

Play continues in the same way with the aim of winning the six thematic reward card.
When a team obtains the six thematic reward card, must face the final question posed by the moderator (bio refinery). If they get it right, they win. If they fail, they must wait their turn for the moderator to ask them a new question.

End of the game

The game ends when a team manages to collect all the theme cards and answer the last question correctly (visit to the bio refinery). At that point, they get "The (shitty) Golden Ticket" and thus the victory.

Session script

The characteristics of the event (Table 13) and the moderator script is detailed as follows:

Content	Description
Duration	30 minutes
Modality	on-site*
Number of participants	5 teams (+2 players) maximun
Number of participants	5 teams (+2 players) maximun
Materials and tools	On-site without internet (physical components): 1. Printed game components (question cards, dice, etc.). 2. Clock or timer to set time limits for answering. 3. Microphone and speakers for the moderator to communicate with the contestants and the audience (optional, depending on the event). 4. Podiums or tables for the teams (optional). On-site with Internet: 1. Printed game components (with the exception of question and answer cards). 2. Electronic devices to access the Q&A platform. 3. Stable internet connection. 4. Projector and screen to show the questions and answers to the participants. 5. Microphone and speakers for the moderator to communicate with the contestants and the audience. Software or online platform to create and present the questions, such as Kahoot or Menti.
Space	• Create three spaces or areas: for participants, moderator and spectators • Space with good lighting and acoustics

	• Depending on the size of the event, the space can vary from e.g. a classroom to an auditorium.
Moderator	• 1 moderator, no bioeconomy expertise required
Contexts of use	• These competitions can be stand-alone events or be integrated into larger activities.

Table 13. Description of the contest session

*Note: While fostering collaboration among stakeholders is most enriched through face-to-face interactions, adapting the game to an online modality or a combination of both are interesting and feasible options. These approaches offer the advantage of reaching a wider audience. The flexibility of the online platform allows people from different geographic locations to participate simultaneously and foster collaboration.

Welcome

Welcome to The (shitty) Golden Ticket, the craziest bioeconomy quiz contest for all ages! Today, we have a very special prize that will surely surprise you... The aim of the competition is to be the first to win the coveted golden ticket. The extraordinary thing about this banknote is its unconventional origin, as it has been made from... animal droppings! Yes, you heard right! This innovative way of making paper shows us how the bioeconomy allows us to find creative and sustainable solutions, so get ready to challenge your bioeconomy knowledge to get the (shitty) golden ticket! (Don't worry, it neither smells nor stains).

Introduction

1. Brief introduction to the contest, highlighting the objectives and the main theme: bioeconomy.
2. Team formation, creation of team name, and selection of a representative.
3. Each team will need a creative and unique name to represent them.
4. Introduction of participating teams and welcome to spectators, if any.

Explanation of the rules

1. Explanation of the rules of the game (see sub section 'game instructions') and any other relevant considerations in the game.
2. Clarification of how the turn system will work and the time assigned for answering each question.

Question rounds

1. Begin the first round of questions by reading the first question out loud.
2. Allow time for the team/s to discuss and decide on their answers.
3. Collect the teams' answers and check them.
4. Read the educational card associated with the answer for more information, if any.
5. Award points to teams that answer correctly and record the scores.

Determining the winner

1. Announce the last question and give teams a chance to answer.

2. Calculate the final scores and declare the team with the highest score as the winner of the quiz.
3. Congratulate the winning team, present the prize and thank all participants for their enthusiasm and knowledge.

Farewell

1. Thank the participants and spectators for participating and encourage everyone to continue learning about the bioeconomy.
2. To inform about the resources hosted on the GenB project website.
3. Say goodbye to the audience and close the competition.

8.1.4 Other dynamics to study their feasibility

The feasibility of proposing the following actions in the framework of the toolkit to boost the collaboration among stakeholders is currently being assessed:

1. Role Play games. Create simulated scenarios where participants take on different roles in the bioeconomy value chain, such as bio farmers, researchers, bio buyers or transporters.
2. Workshops and collaborative projects. Organise sessions that require collaboration between young people, teachers and multipliers to identify problems related to the bioeconomy or solve challenges in their local communities, and develop creative solutions through collaboration and the creation of concrete solutions in a limited period of time. These workshops can be articulated through hackathons, Design Thinking and Human-Centered Design approaches, Lean Startup, among other collaborative and creative frameworks.
1. Organisation of meetups[27], focused on the exchange of knowledge, ideas, experiences and networking. Meetups can include talks, presentations, activities, group discussions or just informal conversations.
2. Participation in forums to share ideas and experiences related to the bioeconomy. This is planned as a section on the GenB project website.
3. Educational and scientific fairs. These events provide opportunities for participants to interact with interactive proposals, presentations and hands-on activities related to the bioeconomy.
4. Environmental awareness-raising events. Activities such as beach clean-ups, tree plantings and recycling campaigns can serve as platforms to discuss bioeconomy issues and promote sustainable practices.

[27] A meetup is an informal - generally less structured- and usually free event where people with common interests meet to socialise, discuss specific topics, share knowledge or participate in related activities. These gatherings are often organised in public settings, such as coffee shops, parks or shared workspaces, and can be flexible in structure, ranging from talks and presentations to hands-on workshops or recreational activities. Meetups are a popular way to make connections with like-minded people, learn from others and build communities around shared interests.

Expected final outcomes

The following results are the ones expected to be achieved. The detailed design of the game instructions - taking into account partner feedback-, which will include the development of an own graphic identity for the contest and a selection of the most suitable quizzes for each age target group of young people. Also a feasibility analysis report of the dynamics listed in the sub-section 'Other dynamics to study their feasibility' as well as the development of those identified as viable and addressable in the framework of the project.

8.1.5 Language versions

The 9 language versions will be available on the GenB website at https://www.genb-project.eu/ by December 2024.

8.1.6 Conclusions

The theoretical approach of the toolkit has been outlined in the previous sections. The full version of the toolkit for boosting collaboration among stakeholders will be available in December 2024, as its development has been conditioned by the interdependence between the different tools that make up the GenB toolkit.

9 Conclusions

The **main objective** of the GenB toolkit is to develop educational kits that are appropriate and effective for each of these groups, in order to promote a deeper understanding and awareness in bioeconomy. Task 1.4 *Toolkits for young people, teachers and other multipliers*, focuses on the development of a six GenB toolkits specifically designed for six target groups. These groups include pre- and early school students (ages 4-8), elementary school students (ages 9-13) and high school students (ages 14-19) as well as teachers, other multipliers and for boosting collaboration among stakeholders.

D1.3 introduces the **GenB toolkit**, which stands out for its reach to a wide audience and the number of tools available. Furthermore, the variety of approaches to interact with the target audience is relevant, as it offers a wide range of innovative and adaptable educational tools. This facilitates the promotion of a comprehensive and participatory understanding of the bioeconomy among various interest groups. The value of the results obtained is set out in the following paragraph.

In total, 21 distinct tools have been developed, exceeding the number outlined in the DoA. 'Book for kids' (T1.4 a) and 'Fairy tale' (T1.4 k) are visual and engaging tools that facilitate the introduction of first bioeconomy concepts in an accessible way at an early age. Video teasers and educational videos (T1.4 d1, T1.4 d2, T1.4 d3) have been identified as highly impactful and engaging audiovisual resources to convey complex information about the bioeconomy, reaching a diverse audience. The card game and board game (T1.4 b1) and 'BioHeroes: Let's save the planet!' (T1.4 b3), respectively - focus on the GBL methodology, thus proposing a playful and entertaining learning framework. The contest 'The (shitty) Golden Ticket' (T1.4 n) also provides this experience. 'Quizzes and educational cards' (T1.4 c) and the gamified educational experience 'Escape4Future - Chemistry meets Circular Bioeconomy' (T1.4 b2) provide a strategy to engage participants in an active and collaborative learning process. The practical activities 'Hands-on experiments' (T1.4 j) and 'Participatory photography' (T1.4 l), propose to the participant an experiential and applied learning. Finally, 'Podcasts' (T1.4 m), 'Online factsheets bioeconomy job profiles' (T1.4 e), 'Educational and information packages' (T1.4 f1, T1.4 f2, T1.4 f3), 'Lesson plans' (T1.4 g1, T1.4 g2), 'Training contents' (T1.4 h), and the 'MOOC' (T1.4 i) present a diversity of pedagogical and learning approaches.

The effort to continue working on an updated and extended version of the high quality GenB toolkit will be prolonged until December 2024, when an updated version of D1.3 will be presented. This second version will be dedicated to the finalisation of the pending materials, the exhaustive validation of the scientific-technical content, as well as the translation into nine additional languages of the vast majority of resources. In addition, other materials developed outside of the initial commitment will be included, thus ensuring comprehensive coverage and greater accessibility of educational resources in the context of the GenB project.

In terms of the **potential impact** of the materials developed in the field of bioeconomy, it is expected that their use will contribute significantly to the improvement of knowledge, awareness and engagement on the concepts underlying the bioeconomy. The heterogeneity of the materials developed makes it possible to reach a wide and diverse audience in terms of

learning preferences, which favours a high impact. In addition, the GenB Project has foreseen that the tools will be used in a variety of contexts, such as formal and informal educational contexts, vocational trainings or awareness-raising campaigns. The beneficiaries of these materials will be those individuals or organisations committed to contributing to the development of solutions based on bioeconomy in our societies. The applied potential of the tools developed in the GenB toolkit is demonstrated through their implementation (see D2.2) and the degree of increased knowledge and awareness of the bioeconomy concept among participants (see D4.2).

The development of the GenB toolkit has been characterised by a series of **challenges**. These include the complexity arising from the number of sub-steps, coordinated and interlinked actions - both outside and within the consortium - to develop the materials (see section 2.6). The content dependency between materials and future events (e.g. video teasers, educational and information packages, lesson plans, training contents, MOOC or toolkit for boosting collaboration among stakeholders) also posed a challenge for the finalisation of the GenB toolkit. Moreover, the realisation of 6 additional materials not initially foreseen (see section 2.4) has involved reviewing and adjusting the work plan and the resources allocated to ensure its production. Despite these challenges, the project provided valuable opportunities for learning and improvement.

In **conclusion**, the GenB toolkit supports the promotion of the bioeconomy and contributes significantly to advancing knowledge, awareness and engagement with bioeconomy concepts.

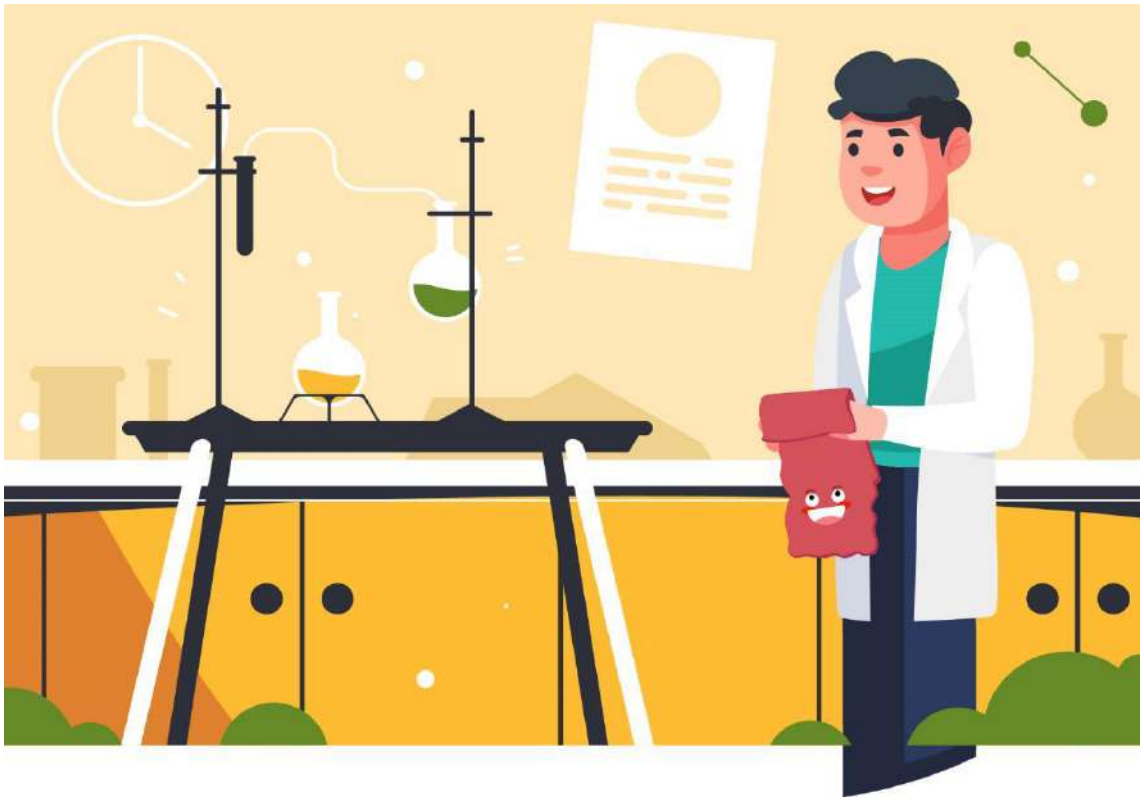
10 Appendix 1: List of tools developed by target group

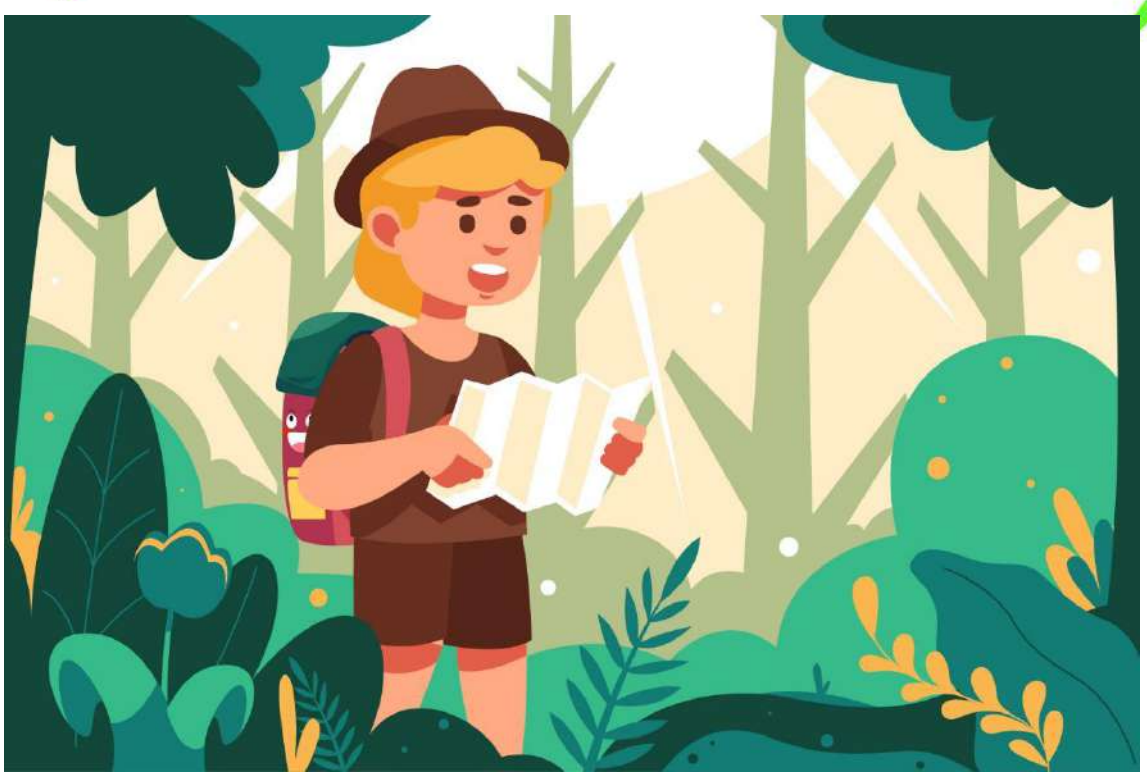
#T1.4n	Activities	#T1.4nn'	Leader	Materials developed by target group					
				YP 4-8 y.o.	YP 9-13 y.o.	YP 14-19 y.o.	Teachers	Multipliers	Boosting collab.
1.4a	Book for kids "What's Bioeconomy" (BIOVOICES) updated version with additional four languages		APRE	X (5-8y.o.)					
1.4b	Game or gamified educational experience	1.4 b1 The educational board game	AIJU, APRE		X				
		1.4 b2 Escape4Future	FVA			X			
		1.4 b3 BioHeroes: Let's save the planet!	AIJU	X	X				
1.4c	Bioeconomy quizzes and educational cards		AIJU			X			
1.4d	Video teasers and educational videos	1.4 d1 ~ for 4-8 y.o	FVA, LOBA	X					
		1.4 d2 ~ for 9-13 y.o	FVA, LOBA		X				
		1.4 d3 ~ for 14-19 y.o	FVA, LOBA			X			
1.4e	Online factsheets "bioeconomy job profiles"		EUN			X			
1.4f	Educational and information packages	1.4 f1 ~ for 4-8 y.o	AIJU				X		
		1.4 f2 ~ for 9-13 y.o	AIJU				X		
		1.4 f3 ~ for 14-19 y.o	AIJU				X		
1.4g	Lesson plans	1.4 g1 ~ for teachers (LP1)	HSPN				X		
		1.4 g2 ~ for multipliers (LP2)	HSPN					X	
1.4h	Training contents		HSPN				X	X	
1.4i	MOOC		EUN				X		
1.4j	Hands-on experiments		APRE	X (6-13y.o.)	X (6-13y.o.)		X	X	
1.4k	Fairy tale		FVA, APRE	X	X	X	X	X	
1.4l	Participatory photography		FVA, APRE	X	X	X			
1.4m	Podcasts		FVA, APRE	X			X	X	
1.4n	Contest 'The (shitty) Golden Ticket'		AIJU	X	X	X	X	X	X

11 Appendix 2: List of video teaser and educational videos developed and selected

Type of the content	Name of the video	4-8 y.o.	9-13 y.o.	14-19 y.o.	Links
Video teasers and educational videos specifically for the GenB toolkit	"What's Bioeconomy?" with GenB Ambassadors (educational video)			X	Video ready before Summer 2024
	Video teaser 1: "Bio-based products" (with GenB Ambassadors)	X	X	X	Video ready by December 2024
	Video teaser 2: "Controversial Issues" (with GenB Ambassadors)			X	Video ready by December 2024
Video teasers and educational videos in the framework of the GenB project during events held in partner countries, to be included in the GenB toolkit	Video reading "The Apple That Wanted to Travel" fairy tale	X	X		https://www.youtube.com/watch?v=SfCR1Of_h0Q&t=416s
	TEDx pitches			X	https://www.youtube.com/watch?v=SfCR1Of_h0Q&t=416s
Video materials produced by third parties, to be included in the GenB toolkit	"What's Bioeconomy? Book for kids"	X	X		https://www.youtube.com/watch?v=Jnt9nLEu3mM&t=79s
	"A Bio-based day"		X	X	https://www.youtube.com/playlist?list=PLtcmfwGu2PB3NdW5cwMb2ciiOdfyVtvvL
	"The Bioeconomy starts here"	X	X	X	https://www.youtube.com/watch?v=2xvXkOMRTs4
	Videos about bio-based materials and products (video series)			X	https://www.youtube.com/playlist?list=PLSTmtfw-s6X1_sE6rFz-4sXjE31L4M3IW
	Videos "Young Bioeconomy Entrepreneurs"			X	https://www.youtube.com/playlist?list=PLbA125z357wRCKgsNBP8Yskd4kR33MJPO

12 Appendix 3: List of video teaser and educational videos developed and selected



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Ci vediamo in giro per il mondo!!!
Melania, la mela che voleva viaggiare