GENB
YOUNG BIOVOICES
FOR A SUSTAINABLE
FUTURE

D1.2

Report on co-design activities

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1. Executive Summary

This report represents a core document of the GenB project. It compiles the results from all co-creation activities of innovative awareness, information and education approaches within the GenB project under task 1.3, namely the Common Ground Camp, the Focus Groups and the Living Labs, and provides an analysis on the reflective observations of these activities. All activities focused on three age groups (4-8, 9-13 and 14-19 years old) and were implemented in the GenB countries and beyond.

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The Living Labs organised in the GenB project aimed to co-create new approaches of cooperation in real life to drive collaboratively the bioeconomy transition with the aim of raising awareness, knowledge and solving problems affecting users. The work in the Living Lab was organised as a series of Living Lab workshops. The process was captured by a structured analysis and compiled synopsis (Chapter 4). It allows drawing conclusions on experiences and insights made during the Living Labs as well as presenting the new approaches developed by and for the three age-groups and lessons learned for improvement.

The Common Ground Camp focused on designing activities, resources and educational proposals on bioeconomy for educating and attracting students of each age group. Based on this co-creation work developed by the groups at the Common Ground Camp, the document outlines the didactic proposals co-created for each age group (Chapter 5).

The Focus Groups aimed to identify young people's preferences and motivations towards bioeconomy and to validate the methodologies and didactic proposals created in the Common Ground Camp. The results of the focus groups are presented in this report (Chapter 6), providing an overview of the most preferred educational formats according to the three age-groups.

In summary, this report is a valuable compilation of the GenB project's co-creation efforts, offering an understanding of the methodologies, results, and reflections that drive the project's mission to enhance bioeconomy education and awareness across diverse age groups.

2. Introduction

GenB contributes to the implementation of the updated 2018 EU Bioeconomy Strategy and the European Green Deal priorities, as well as to the achievement of a climate-neutral Europe by 2050 and the Sustainable Development Goals. Related to this, WP1 intends to explore existing awareness, information and education contents about bioeconomy, as well as making this content easily available. Furthermore, WP1 aims to co-create innovative approaches for awareness, information and education on bioeconomy, environmental issues, sustainability and circularity and cooperation between teachers, parents and youth to drive collaboratively the bioeconomy transition towards a more sustainable production, consumption and lifestyle. Inside this work package. Related to this general aim of WP1, Task 1.3. deals with the co-creation of innovative awareness, information and education approaches.

This deliverable, deliverable 1.2: Report on co-design activities describes the activities implemented within task 1.3 and analyses their results and outcomes. Thereby, the deliverable refers to the following three subtasks:

1. GenB Living Labs
2. Common Ground Camp
3. Focus Groups

Although sequentially the last subtask in this task, in this report the Living Labs are presented first after the presentation of the summary of the co-creation activities in this task (Chapter 3) as they include the most recent results of the project. After that, the Common Ground Camp is presented in detail whose results were then validated in the focus groups which come last in this report.

The GenB Living Labs were implemented in Austria, Italy and Slovakia. Each country implemented three Living Labs, namely one per age group (4-8, 9-13 and 14-19 years old). Each Living Lab was organised as a series of a minimum of three workshops for each of the age groups. The first part of the relevant chapter (Chapter 4) is dedicated to the methodological approach of the Living Labs, including the guideline for implementation, the reporting template for data collection and the analytical lens for the evaluation of the results. Following this, the results of the comprehensive analysis of all Living Lab reports are described. The chapter on the Living Lab ends with conclusions focusing on reflection and lessons learnt for improvement.

The Common Ground Camp was one of the key events in the GenB project. Within this deliverable the first part of the chapter on the Common Ground Camp (Chapter 5) gives a concise overview of the Common Ground Camp and its objectives, while also providing insights into the preliminary planning and design phase of this participatory event. Additionally, also the meticulous process employed for selecting educators to participate in the co-creation workshops and the methodology used for inviting speakers is outlined. Furthermore, it provides context for the talks delivered by the invited speakers. In the second part the insights from the

co-creation activities developed in the GenB Common Ground Camp, held in Athens on 21-22 February 2023, are gathered. In the frame of these activities, the face-to-face participants in the Common Ground Camp, based on their expertise and experience, were divided into a total of 4 groups to co-create innovative approaches of teaching 4-8-year-olds, 9-13-year-olds and 14-19-year-olds (two groups) about the concept of bioeconomy. Each group was composed of people from different countries and contexts, with specific experience working with the age group in question and focused on thinking and designing activities, resources and educational proposals that would be interesting and effective in educating students of each age group in bioeconomy. Based on the co-creation work developed by the groups at the Common Ground Camp, the didactic proposals co-created for each age group are presented in the respective chapter, together with the posters created at the event and a detailed explanation of the activities.

Focus groups were organised to identify young people's preferences and motivations towards bioeconomy. The focus groups were conducted by GenB researchers and teachers given their expertise on the transmission of knowledge to young students. The focus group sessions were conducted with students based on the three age groups determined by the project I.e., 4-8, 9-13 and 14-19 years old. In most of the cases they were carried out physically, while some of them were conducted online, but the structure, methodology and data retrieval were kept homogeneous in all cases. In the first part of the chapter (Chapter 6), information is provided on the methodology, describing the participants, the context and conditions in which the focus groups took place, information on the moderators of the sessions, the ethical procedures and the structure and content of the sessions. The conclusions of the sessions with an overview of the most preferred educational formats and a specific conclusion about them for each target group are included as well.

In total the deliverable is divided into four main chapters:

1. Chapter 3: Part one - Co-creation of innovative awareness, information and education approaches: General summary of the three related tasks and their conclusions.
2. Chapter 4: Part two - Living Labs
3. Chapter 5 Part three -Common Ground Camp
4. Chapter 6: Part four - Focus Groups

Finally, the rich appendix provides various material connected to all subtasks for further information and inspiration on the topic.

Chapter two of this document serves as a brief summary of the results of the three interlinked subtasks - GenB Living Labs, Common Ground Camp and focus groups. This chapter is intended for those seeking a comprehensive overview without delving into the intricate details of task implementation. For readers who have limited time or prefer a more streamlined perspective, chapter two provides a valuable snapshot of the GenB project's achievements and results. Chapters three to five, on the other hand, go into great detail on the individual subtasks and provide a comprehensive understanding of their implementation, results and reflective findings. With this division, we aim to meet the different needs of the readers and provide a comprehensive understanding of GenB's contributions to the EU Bioeconomy Strategy 2018, the

European Green Deal, Climate Neutrality by 2050 and the Sustainable Development Goals through innovative awareness raising, information and education on bioeconomy and sustainability.

3. Part one: Co-creation of innovative awareness, information and education approaches

3.1 General summary of activities and outcomes

GenB project partners were successful in implementing the activities set-out in Task 1.3. More importantly new insights and approaches to educate and raise awareness of the generation Bioeconomy could be developed and validated with the target groups. This comprehensive effort has laid the foundation for more effective, engaging and sustainable bioeconomy education and represents a significant success for the project and its stakeholders.

Detailed results in relation to the co-creation approach and outcomes are summarised below.

3.1.1 Co-creation approach

3.1.1.1 Living Labs

The aim of the GenB Living Labs was to employ a co-creation methodology to guide students to collaborate in developing new innovative formats, approaches, methods, tools to facilitate bioeconomy awareness and education. These Living Labs, one for each target age group, operated in three partner countries (Austria, Italy, Slovakia) and involved children, young adults, parents, teachers, and other education professionals from both formal and non-formal settings. The Living Labs process in Austria, Italy (with 4-8-year-olds and 9-13-year-olds) and Slovakia took place between April and June, while that of 14-19-year-olds in Italy started at the same time and ended in October 2023. It involved the implementation of at least three workshops for each Living Lab (Italy managed to hold four workshops for each of their Living Labs).

The Living Labs at the core of the GenB project are founded on co-creation processes, structured around four main stages, each emphasising co-creation:

1. **Co-creation/Co-design (Ideation):** In this initial stage, participants employ various co-creation tools and methodologies to generate a portfolio of ideas aligned with their specific objectives.
2. **Exploration**: Building on the idea portfolio, participants delve into the concepts in greater depth and collaboratively decide which ideas to pursue. Prototypes are developed or brought to life, ready for deployment in the next stage.
3. **Experimentation**: At this stage, participants test the prototypes or products with the target audience. This phase focuses on gathering feedback and insights to assess their effectiveness.
4. **Evaluation**: The final stage involves participants reflecting on how their products were received by the target audience, evaluating whether they achieved their intended objectives. Any necessary adjustments or adaptations are identified to optimise the project's alignment with the desired outcomes.

Given the complexity of the bioeconomy topic, participants needed continuous support to enhance their knowledge and build capacities in areas like pitching, storytelling, and design thinking. These skills proved essential for the successful development of their projects and products throughout the co-creation process.

3.1.1.2 Common Ground Camp

The GenB Common Ground Camp, which took place on 21-22 February 2023 in Athens, was structured to engage a wide range of stakeholders in education, encompassing both formal and non-formal educators. This included universities, education policymakers, regional authorities, school administrators, teachers, and various facilitators such as museums, science communicators, youth organisations, and community groups, as well as EU-funded projects/initiatives. The primary objectives of this workshop were to:

1. **Raise Awareness**: The central aim of the event was to increase awareness of the critical need for advancing bioeconomy practices within both formal and non-formal educational settings.
2. **Facilitate best practice sharing**: The event sought to enable the exchange and adoption of best practices among the participating communities, fostering a culture of excellence in bioeconomy education.
3. **Gather fresh insights**: Through this workshop, it was to gather novel insights into the methods of teaching, learning, and effectively disseminating knowledge about the bioeconomy, addressing the unique needs and challenges of both formal and non-formal educators for different age groups of children namely: 4-8, 9-13 and 14-19.

The latter objective is a key focus of this report, as it pertains to the co-creation process within the event, using the "world Cafe" method (see Chapter 5 for the exact details of the methodology). Before the event commenced, the organisers were particularly committed to ensuring the active participation of specific profiles. They meticulously structured the group work, making certain that participants with the most expertise on the topic and target group were effectively distributed among the teams. Each of these groups consisted of individuals from various countries and diverse educational contexts, each possessing specific experience related to the respective age group.

In line with the "world Cafe" method, participants engaged in discussions at designated tables, with each table having a moderator who guided the conversation. After a set period, the entire group moved collectively to the next table, leaving the moderator at their original table. This method allowed for the seamless exchange of ideas and ensured that all attendees had the opportunity to contribute their insights and experiences to each of the formats created.

The face-to-face participants in the Common Ground Camp were divided into a total of four groups, to co-create innovative approaches of teaching 4-8-year-olds, 9-13-year-olds and 14-19-year-olds (two groups) about the concept of bioeconomy.

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3.1.1.3 Focus groups

The focus groups had the primary objective of validating the methodologies and didactic proposals formulated during the Common Ground Camp. In the focus groups, these proposals were presented to the students by the GenB Project researchers or by their own teachers, with the aim of finding out the preferences and interests of the children and young people in relation to these proposals, obtaining first-hand information from the target group itself.

This allowed delving into the preferences and motivations of young individuals regarding bioeconomy and pro-environmental actions. The focus groups employed methodologies such as the CHANGER segmentation profiles, a cluster analysis made by AIJU in a previous project based on a qualitative and quantitative study carried out in five European countries, in which children are classified based on their attitudes, interests and preferences (see Chapter 6 for the exact details of the methodology) and factored in demographic variables, including gender, social class, and culture. GenB researchers and teachers orchestrated these sessions, classifying students into the three GenB age categories: 4-8, 9-13, and 14-19 years old. The majority of the focus group sessions were conducted in person, while some took place online. However, all adhered to a consistent framework and methodology aimed to craft educational experiences tailored to the interests and characteristics of the students, ultimately fostering meaningful learning.

The focus groups were conducted by the three GenB partners AIJU (Spain), HSPN (Greece) and EUN (Pan-European). The focus groups in Spain and Greece were carried out with pupils of the three age groups. In both cases, AIJU and HSPN recruited participants through their network of collaborators, with children's participation being completely voluntary. On behalf of EUN, after an open call for teachers from different countries, the selected teachers developed the focus groups with their own group of students. EUN then held online focus groups with teachers to gather information that emerged from the classroom discussions, and to collect students' preferences and views. A total of four focus groups sessions of 1 hour per session were conducted online, with an average of seven teachers per session.

In total, 11 European and 3 South-East Asian countries were reached: Bulgaria, Croatia, Greece, Ireland, Italy, Portugal, Republic of North Macedonia, Romania, Serbia, Spain and Sweden, on behalf of Europe; and India, Pakistan, and Turkey on the South-East Asian countries' side.

Summing up, the focus groups consisted of two distinct parts:

- Research on the personal interests of the participating students.
- Research on the perceptions of the participating students on the didactic proposals for Bioeconomy education co-created in the Common Ground Camp.

Both aspects are closely related and are key to offering children and young people educational experiences adapted to their interests and characteristics, with the aim of facilitating the acquisition of meaningful learning.

3.1.2 Outcomes

3.1.2.1 Living Labs

The anticipated outcomes of the Living Labs were twofold. Firstly, the objective was to involve not only students and their teachers but also parents and various stakeholders in the process. Secondly, the Living Labs aimed to generate novel formats and approaches for bioeconomy education and awareness.

In terms of the first expected outcome, partial success was achieved. It proved challenging across all three countries and age groups to directly engage parents and other stakeholders in the Living Labs process. A noteworthy exception was the Living Lab for 4-8-year-olds in Slovakia, where some parents participated in the second and third workshops. Additionally, in Slovakia, the collaboration with a leisure centre enriched the Living Lab by involving staff with an educational background. In Italy, parents and stakeholders were engaged in the final workshops, which were held in conjunction with larger events. Although direct involvement of parents was limited in Austria, Italy, and Slovakia, participants were consistently encouraged to share their experiences with their families and request feedback on their project and product ideas. In some instances, Living Lab moderators assigned tasks that explicitly required support from parents and families. In Austria, the results of the Living Labs involving both 4-8-year-olds and 9-13-year-olds were showcased at the school's summer festival, which took place after the final workshop. Despite the event being outside of the Living Labs process, it was still possible to directly involve families and the local communities in this way.

Nevertheless, the mere implementation of these Living Labs is an accomplishment in itself. GenB partners established partnerships with schools and, in the case of Slovakia, also with a leisure centre for children and young adults. In Austria, a total of about 120 participants were engaged in four Living Labs across age groups. Italy and Slovakia each successfully conducted one Living Lab per age group, with approximately 60 participants in each country.

Concerning the second expected outcome of creating innovative formats and approaches (also referred to as projects or products in this report) for bioeconomy education and awareness, the GenB Living Labs not only met but exceeded these expectations. Each Living Lab in Austria and Slovakia produced more than one project or product. In Italy, the Living Labs with two younger age groups worked on one project, while the 14-19-year-olds focused on a different project. Although the Italian Living Labs may not have generated as many products and projects in terms of quantity, they developed relatively complex formats, such as board games and escape games. By the final workshops, these formats had reached an advanced prototype stage, offering potential for further development and production. The varying quantity and sophistication of the projects and products developed by the Living Labs in the three countries can be attributed hugely to the role of the GenB project partners in the process. Whereas in Austria and Slovakia the Living Lab facilitators primarily took on a facilitation role, in Italy the facilitators were more actively involved in all the stages of the Living Lab process resulting in fewer but more elaborate and intricate results.

The variance in both the quantity and quality of final products can be attributed to the roles played by the GenB partners within the Living Labs. In Austria and Slovakia, GenB staff primarily served as facilitators, with the exception of the Living Lab involving 4-8-year-olds in Slovakia. In contrast, in Italy, GenB staff not only facilitated the workshops but also actively engaged in all phases of the Living Labs, spanning from ideation to experimentation (detailed in Chapter 4.2.1.2). Workshop reports from the Living Labs indicate that time emerged as a significant factor influencing the role of GenB partners and the innovative development of participants' ideas. All GenB implementing partners across the three countries concur that a more extensive timeframe is essential to maintain a user-centred approach and, simultaneously, yield high-quality, well-considered outcomes.

The following section provides an overview of the products and projects created by the Living Labs participants, categorised by age group and country. For details on the ideation, prototyping and experimentation phases that led to these results, please review Chapters 4.2.4.5, 4.2.4.6 and 4.2.4.7 respectively.

3.1.2.1.1 Living Labs with 4-8-year-olds

3.1.2.1.1.1 Austria

In Austria, due to the high number of participants, two separate Living Labs were held for 4-8-year-olds. Together they developed the following projects and products.

1. Poster with ideas of products that could be made from different bio-based materials
2. Flowerpots from tetra packs and fabric remnants
3. Purses from tetra pack
4. Pencil case from recycled plastic bottles
5. Bags from fabric remnants
6. Photo frame embellished with plastic bottles

3.1.2.1.1.2 Italy

In Italy, both the Living Lab with 4-8-year-olds and 9-13-year-olds worked in the same product, namely an educational board game with the objective of transforming a biomass into a new bio-based product. This is achieved by exchanging biomasses with other players, extracting biomasses from different areas of the world (city, seaside, countryside, forest), answering correctly to questions and acting on the various steps where you land on.

3.1.2.1.1.3 Slovakia

Series of brochures/booklets with explanatory text and illustrations on the topics such as impacts of climate change, greenhouse effect, examples of environmentally friendly behaviour, circular economy initiatives and the bioeconomy in daily life.

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3.1.2.1.2 Living Lab with 9-13-year-olds

3.1.2.1.2.1 Austria

1. A bioeconomy magazine
2. A series of educational videos on (circular) bioeconomy and sustainable habits and practices

3.1.2.1.2.2 Italy

See Chapter 3.1.2.1.1.2 (Both the Living Labs with 4-8-year-olds and that with 9-13-year-olds worked on the same product: A board game on bioeconomy)

3.1.2.1.2.3 Slovakia

Series of comics and posters following the story-telling technique on topics including – How climate change occurs and role of humanity, the contribution of (circular)bioeconomy to the fight against climate change, examples of human behaviour as consumers and the bioeconomy in our daily lives.

3.1.2.1.3 Living Lab with 14-19-year-olds

3.1.2.1.3.1 Austria

1. **Educational video series**: with videos covering various aspects of the bioeconomy, such as upcycling of clothes, media influence, economic consequences, sustainable energy resources, transportation, and bioeconomy in politics.

2. **Elementary school education**: teaching an elementary school class about bioeconomy through theory and hands-on experiments.

3. **Sustainable packaging advocacy**: sending an information email to the head of a supermarket chain addressing packaging reduction and the potential use of bio-based packaging.

3.1.2.1.3.2 Italy

Escape game with the narrative ": Our planet is trapped in a dangerous linear model of production, consumption and lifestyle... let's find a solution through the Bioeconomy escape game!"

3.1.2.1.3.3 Slovakia

Bioeconomy board game inspired by monopoly

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3.1.2.2 Common Ground Camp

Regarding the co-creation objectives of this camp, the event not only achieved but also exceeded its intended goals. Specifically, it successfully generated innovative and thought-provoking activities, resources, and educational concepts designed to effectively engage and teach students of various age groups about the bioeconomy. In total, the event yielded five concrete proposals, with two proposals each, catering to the 9-13-year-olds and the 14-19-year-olds. Notably, the second proposal for the 14-19 age group introduces seven distinct formats within the same proposal. Additionally, the remaining ideas also provide a diverse range of formats, ultimately resulting in the creation of even more educational concepts. The following formats were developed:

3.1.2.2.1 Early childhood education: 4-8-year-olds

3.1.2.2.1.1 Learning about bioeconomy through the olive tree and its derived products

The proposal primarily focuses on the olive tree, given the Mediterranean background of the group members from Spain, Portugal, Greece, and Cyprus. This collective effort aims to protect the olive tree and transition toward bioeconomy practices. Importantly, the proposal is versatile and can be adapted to any tree or species. Its core strength lies in connecting with students' real-life experiences and prior knowledge, making learning more meaningful and accessible.
To achieve this goal, the proposal follows a classic teaching-learning structure: introduction, development, synthesis, and conclusions. This structure uses the metaphor of a tree to represent each phase - roots for introduction, trunk and branches for development, and leaves and fruit for synthesis and conclusions.

Furthermore, the proposal is flexible, allowing for adjustments based on the context of application and tailored to the specific needs of the target group. It provides various activities, which can be modified or selected to suit the educational context.

Additionally, the proposal includes the creation of a teacher-friendly glossary of relevant terms to facilitate the implementation of this educational approach (for more details on this format, please review Chapter 5.2.1).

3.1.2.2.2 Primary school: 9-13-year- olds

3.1.2.2.2.1 The Bioeconomy Olive tree (board game/book)

This proposal, following a similar metaphor as the previous group, utilises the olive tree as the basis for bioeconomy education. The tree serves as a framework for various activities. It is presented as a board game or book with interactive pop-up elements, each presenting a challenge for students to solve. There are a total of 9 distinct challenges that cover various aspects of bioeconomy-related educational content (for more details on this format, please review Chapter 3.1 of the report on the common ground camp).

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3.1.2.2.2.2 Olive challenges

This proposal is designed for children aged 9 to 12 and is structured for a month-long curriculum. It involves group work to facilitate learning support and positive interdependence among students.

Cantered around the olive tree metaphor, this proposal employs project-based learning or problem-based learning. It comprises five distinct phases, each offering challenges through various activities and dynamics to gradually cover curricular content.

As students successfully complete challenges, they earn "green points" as rewards, enabling access to subsequent challenges. This gamified approach acts as a motivational factor, enhancing student engagement.

To enhance the proposal, it's recommended to create a glossary of essential concepts for teachers, including terms such as Bioeconomy, bioeconomy-related jobs, bio-based products, services, circular economy, waste, sustainability, and biomass (for more details on this format, please review Chapter 5.2.2).

3.1.2.2.3 Secondary school: 14-19-year-olds

3.1.2.2.3.1 BioMarathon

The proposal introduces a "BioMarathon" aimed at fostering pro-environmental attitudes among students in an engaging and dynamic manner. This BioMarathon is designed as a competition that challenges students to complete stages, making it a motivating concept for teenagers who are interested in both competitive and collaborative activities. It's intended for students aged 13 to 19 and can be organised as a school-wide competition. The BioMarathon spans a school year but typically lasts 3 to 6 months, with suggested starting and ending points tied to significant dates, like Food Waste Day.

As a globalizing project that integrates various subjects, the BioMarathon encourages systemic thinking. Each year, new topics can serve as a common thread for the event, such as reducing and reusing, local biomass utilization, and addressing food waste. It emphasises clear communication and setting realistic, progressive challenges based on a collaborative needs assessment. Activities within the BioMarathon can encompass experiments, Living Labs, social innovation actions, excursions, competitions, artistic endeavours, and more. Visual tracking of progress and activities is recommended to motivate participants and provide a clear view of results (for more details on this format, please review Chapter 5.2.3).

3.1.2.2.3.2 Didactic tools to boost bioeconomy in secondary schools

The proposal presents a range of didactic tools to enhance bioeconomy education. These tools include:

1. **Coding Games**: Employing gamification, coding games provide challenges that make learning about bioeconomy enjoyable. This may involve QR codes, digital quizzes (e.g., Kahoot, Mentimeter), or traditional games.

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2. **Video Games**: Utilizing video games offers students an engaging way to explore curricular content from a playful perspective.

3. **Market - Fair**: Celebrating markets or fairs can capture students' attention and encourage community involvement. Students take on influential roles in promoting the transition to the bioeconomy. Options include second-hand product markets and selling bio-based student creations.

4. **Social Media**: Social networks are leveraged as a didactic tool to engage students and deliver curricular content in a motivating and attractive manner. Students may work on content as influencers, developing campaigns using hashtags and promotional videos.

5. **Citizen Science**: Involvement in open science or citizen science projects empowers students to take leadership roles in processes that have real-world impacts, facilitating tangible learning.

6. **Arts**: Creative arts, such as dance, music, and visual art, contribute to bioeconomy learning and promotion. Students can create artistic works and DIY bio-based products.

7. **Podcasts / Journalists**: Students act as journalists, producing content in various formats like podcasts, magazines, pamphlets, and blogs to raise awareness about the bioeconomy. These tools offer dynamic ways to explore and promote bioeconomy education.

For more details on this format, please review Chapter 5.2.3

3.1.2.3 Focus groups

The main finding of the focus groups is that the didactic proposals for bioeconomy education originating from the Common Ground Camp obtain a high level of students' interest and attraction to the topic, even though many had little prior knowledge of bioeconomy. Students recognise the importance of learning about Bioeconomy for a more sustainable future, which emphasises the need to continue working on this subject and underscores the significant role that young generations can play in transitioning toward a sustainable and circular Bioeconomy.

In terms of learning preferences, students across all age groups favour activities that involve collaboration, group engagement, and active participation. They are particularly drawn to activities that allow them to exchange ideas and collaborate, which aligns with their digital inclinations. Gamified experiences, both in virtual and real-life settings, are also well-received, fostering healthy competition and collaboration. Additionally, students appreciate formats that facilitate communication and the exchange of ideas, such as podcasts, and they value accurate information for forming their opinions. Lastly, students express an interest in experimental activities that involve hands-on interactions with various resources, materials, and formats.

In total 910 students and 29 teachers participated in the focus groups, giving a total of 939 participants.

3.1.2.3.1 Early childhood education: 4-8-year-olds

For children aged 4 to 8, the child profiles Creative Heroes, Green Explorers, and Notable Achievers, are prevalent. To align educational activities with their interests, proposals in bioeconomy should be presented as challenges that contribute to societal and environmental improvements. Emphasising the positive impact on the environment is crucial.

Regarding preferred activities, games are highly attractive to these children. Gamified activities with a playful-pedagogical approach are effective for bioeconomy education. Cooperative and team games facilitate learning while having fun and sharing experiences with others. Cooking workshops also engage these children, offering hands-on learning experiences.

Additionally, children in this age group express interest in fairs, as they value shared moments with family, friends, and teachers. Field trips are appealing, allowing them to be outdoors, engage with nature, and associate the activity with research. Learning through videos and songs, as well as conducting focus groups, are also favoured activities in some regions.

3.1.2.3.2 Primary school: 9-13-year-olds

For children aged 9 to 13, the prevalent child profiles are Notable Achievers, Experimental Makers, and Green Explorers. To engage this age group in Bioeconomy education, activities should present challenges that require the application of mental and physical skills. Combining competition with cooperation can be motivating. Competitive activities, BioMarathons, and team-based tasks are likely to capture their interest. Moreover, activities should offer opportunities to work with diverse materials, resources, and hands-on learning, such as workshops and experiments. Connecting Bioeconomy education with sustainability and environmental care is also important.

Among the activities, games are highly favoured and considered a fun and motivating learning approach, enjoying strong consensus among children of this age group. Experiments are also well-received, providing a positive and engaging learning experience. Role-playing, where children can simulate scenarios and assume different roles, is stimulating for them. Pop-up books are the only activity that doesn't capture their interest, as it is seen as more suitable for younger children.

In various regions, fairs, research projects, focus groups, and workshops also appear among the top 3 activities of interest for this age group, reflecting their diverse and engaging preferences for learning about Bioeconomy.

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3.1.2.3.3 Secondary school: 14-19-year-olds

For young people aged 14 to 19, there is a wide range of interests and motivations reflecting their diverse personalities as they are in the transition into adulthood. This group values activities that allow interaction, discussion, and co-creation, particularly with peers of their age. Trendy and fashionable topics, such as fashion, entrepreneurship and digital technologies get their interest and offer potential avenues for bioeconomy education. They also highly value activities that enable self-expression with art, music, dance, cooking and other artistic forms serving this purpose.

Due to this diversity of interests, there is also broad dispersion in preferences for co-created educational proposals. Notably, citizen science activities, debates, hackathons, intergenerational activities, and storytelling are less popular within this age group.

Among the preferred activities, field trips hold a significant place for AIJU and EUN partners. Young people value the opportunities for interaction, socialising with friends, and the playful dimension of these activities. Recipe books capture the interest of AIJU and HSPN students, with cooking considered an engaging and useful activity. Other activities ranking in the top 3 include challenges and podcasts (EUN), fairs, BioMarathons, and video games (HSPN), and experiments, social networks, games, artistic activities and Living Labs (AIJU).

In summary, the diverse interests and preferences of this age group highlight the need for a variety of activities, formats, and personalised learning experiences to engage them effectively in Bioeconomy education.

4. Part two: Living Labs

4.1 Methodological approach

The following section introduces the methodology used for the Living Labs organised in the GenB project.

The concept of Living Labs is relatively novel concept that emerged in the early 1990s e.g., Bajgier et al.,1991. Professor William Mitchell whose most prominently associated with Living Labs later introduced the element of Living Labs being a 'user-centric' methodology (Eriksson et al., 2006; Van Geenhuizen, 2019). He defined Living Labs as 'a research methodology for sensing, prototyping, validating and refining complex solutions in multiple and evolving real-life contexts' (Eriksson et al., 2006). In contrast to traditional labs, Living Labs are characterised by the fact that they take place in 'real-life' context and are 'user-centred' or 'user-driven'.

Using the categorisation by Leminen and Westerlund (2012) ZSI organised a provider-driven lab, hence a lab that is initiated by an organisation with the aim of raising awareness, knowledge and solving problems affecting users. Drawing on the definitions of Leminen and Westerlund (2012), Schaffers et al (2015), Hassan (2014), Hagy et al. (2017) and Gúzman et al. (2013) the following core features of Living Labs can be deduced:

- Living Labs are user-centred, that is, the strong focus and involvement of 'users' as participants
- Living Labs require a heterogeneity of participants
- Living Labs involve an experiential learning approach
- Living Labs are set in a real-life context
- Living Labs involve the co-production of knowledge through co-creation methodologies

Living Labs generally involve several stages. For the purposes of the GenB Living Labs the stages described by Leminen and Westerlund (2012) and those used in the Inmédiats Handbook (Millet et al. 2014) as well as those in the Methodology for the engagement of school Living Labs with stakeholders in the SALL – school as Living Labs project (Franse, R. 2021):

1. **Co-creation/co-design**: This is the ideation stage. With the help of different co-creation tools and methodologies, the participants develop a portfolio of possible ideas that they could implement to reach their desired goals.

2. **Exploration**: With the portfolio of ideas, at this stage the participants explore the ideas in more detail and together come into a consensus on which ideas they would like to produce and experiment on. Here, the develop prototypes of the ideas or bring them to life in accordance with what the idea is ready to deploy them to the target population in the next stage. As with the previous stage, co-creation tools and methodologies come in very hand. Possible methods dialogue cafés, storytelling and focus groups (Gúzman et al., 2013).

3. **Experimentation**: At this stage, the participants test the developed prototypes or products with the target population. Like with the previous stages, co-creation tools and methodologies specifically for experimentation are quite useful. Possible methods include mock-up development, storyboarding etc. (Gúzman et al., 2013).

4. **Evaluation**: At the last stage, evaluation, the participants of the Living Labs reflect on how their product or products were received by the target population, whether they managed to reach the goals they were intended for and whether any tweaking or adaptation is required to make the product or products reach the goals better. This exercise like with the other stages is also guided by co-creation methodologies and tools. Possible methods include heuristic evaluation and co-joint analysis (Gúzman et al., 2013).

These four stages can be done once or several times iteratively depending on the needs.

The GenB Living Labs were implemented in Austria, Italy and Slovakia. Each country implemented at least three different Living Labs, namely one Living Lab per age group: For 4-8-year-olds (pre- and early school), 9-13-year-olds (primary school and early secondary school) and 14 -19-year-olds (secondary school). Each Living Lab was organised as a series of at least three workshops for each of the age groups per country. Importantly, Living Labs consistently existed throughout the period of the workshops, with the phases in between being vital to the workshop following thereafter.

In total, 10 Living Labs (i.e., 3 in Italy and Slovakia each and 4 in Austria: two for the 4-8-year-olds) and 33 workshops (3 per Living Lab in Austria and Slovakia and 4 per Living Lab in Italy) had been organised at the point of writing this deliverable. As the goal of presenting and evaluating the results of the pilot projects could not be reached in the third workshop of the oldest age group (14-19-year-olds) in Italy, FVA organised additional workshops for the implementation phase, in the framework of two large-scale events in October (Maker Faire Rome and Fermhamente festival).

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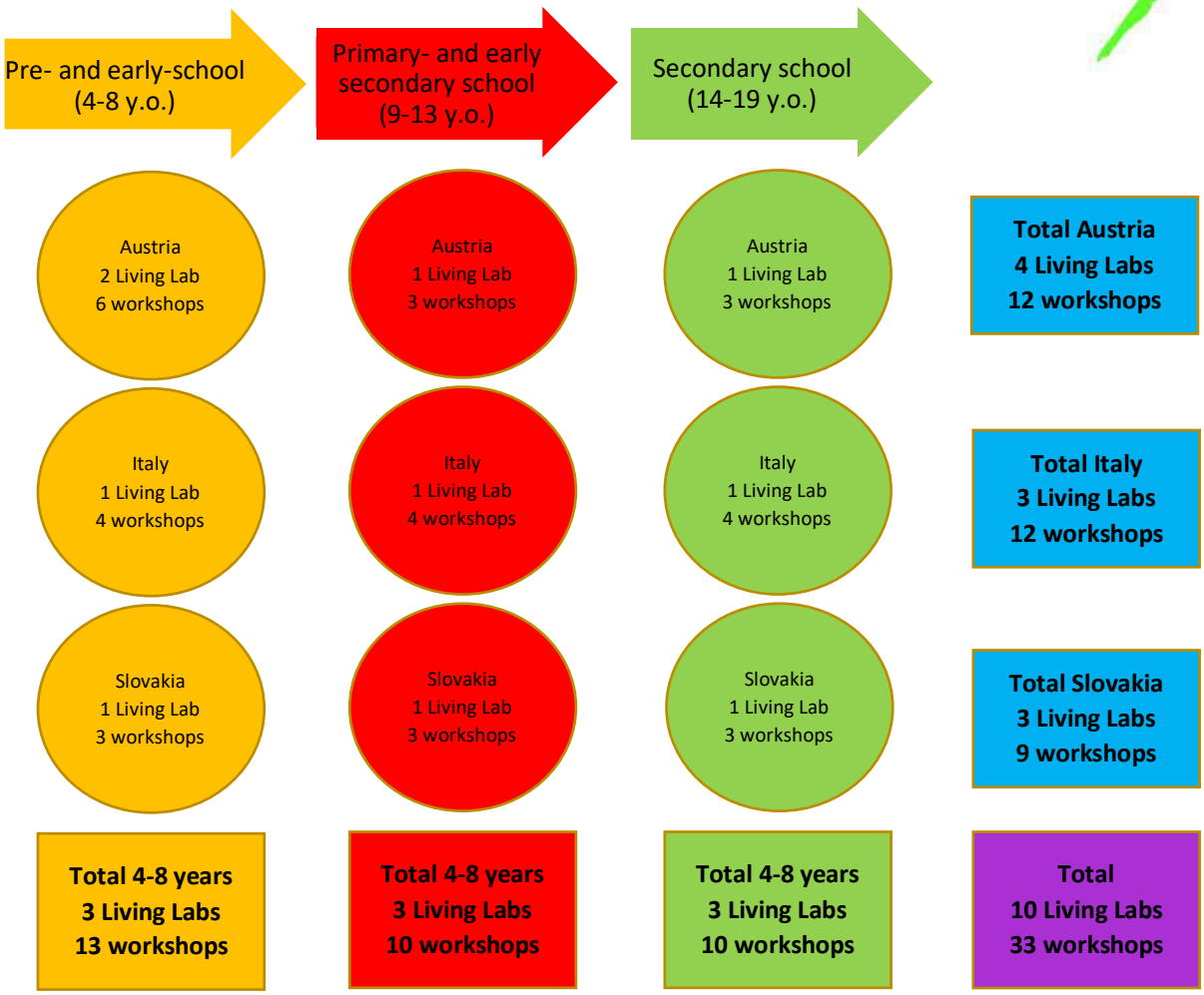

Figure 1: The Living Lab process in the GenB project

4.1.1 Guideline for Living Labs

In order to align the methodology for all partners involved, ZSI set up a guideline for all partners involved in the Living Labs. This guideline includes the following sections:

1. A definition of Living Labs, explaining the concept behind as well as the specific approach taken in the GenB project. A part of this definition has been also included in the first part of this methodology section.
2. The set-up of Living Labs per age group in a series of three workshops per country (Figure 1 shared in this deliverable stems from this part).
3. The foreseen participants of the workshops and possibilities to engage participants
4. Detailing the roles involved in a Living Lab to ensure that each position is covered thoughtfully throughout the process
5. A detailed description of the different goals for each workshop as well as possible methods to be involved
6. A preview of ZSI's approach in organising the three Living Labs in Austria

The guideline prepared by ZSI has been discussed with APRE, FVA and PEDAL and shared in early 2023. The full version can be found in Appendix 7.1 of this deliverable.

4.1.2 Living Lab reporting template for data collection

In order to align the reporting process, ZSI created a reporting template (see Appendix 0). This reporting template was to be filled for each workshop for each of the Living Labs organised and covered the following sections:

- General information about the workshop (date, location, organiser, age-group, workshop number)
- The agenda of the workshop
- The invitation of the engaged parties
- The workshop content and results
- The employed methodologies and tools
- A section on reflection and lessons learned

The reporting templates were collected and reviewed by ZSI. Contrary to the originally foreseen process, the Italian (APRE & FVA) and Slovakian (PEDAL) partners did not complete one reporting template per workshop per age group. Instead, each completed one template per age group reporting on all of the organised workshops at once, resulting in 3 templates reporting on the Italian Living Labs and 3 templates reporting on the Slovakian Living Labs. ZSI completed one template per workshop, however, since the Living Labs for the younger two age groups were implemented in an identical manner, the reporting templates were merged, resulting in 6 filled templates. All of this material can be found in Appendix 0 of this deliverable.

4.1.3 Analytical lens

The collected reporting templates were carefully analysed using the support of the qualitative analysis software Maxqda. More specifically, all 15 reporting templates (6 from the Austrian Living Labs, 3 each from the Italian and Slovak Living Labs) were carefully read and systematically coded using qualitative content analysis (Mayring 2000). Codes in this regard relate to content dimensions of the analysed reports and were both created deductively, i.e., prior to the analysis of the material using the structure of the reporting template as guiding theme, as well as inductively, i.e. generated while analysing the reports themselves to capture important dimensions not yet included in the code tree (see Table 1 below showing the final code system used).

Codes used	Frequency of Attribution
	1308
Facilitation	0
Facilitation\Role of GenB partners	12
Facilitation\Invitation	16
Facilitation\Invitation\Positives	4
Facilitation\Invitation\Existing relationship with school from previous projects	3
Facilitation\Set up	73
Facilitation\Methods & Tools	44
Facilitation\Reflection	16
Facilitation\Reflection\Feedback "from" participants	27
Facilitation\Reflection\Reached objectives	15
Facilitation\Reflection\Objectives not (fully) reached	9
Facilitation\Reflection\Strengths	89
Facilitation\Reflection\Challenges	75
Facilitation\Lessons for improvement	44
Content	0
Content\Introduction of Team/Workshop/LLProcess	16
Content\Introduction of Team/Workshop/LLProcess\Challenges	4
Content\Introduction of Team/Workshop/LLProcess\Strengths	10
Content\Introduction of Team/Workshop/LLProcess\Methods & Tools	14
Content\Familiarisation with bioeconomy	23
Content\Familiarisation with bioeconomy\Methods & Tools	28
Content\Familiarisation with bioeconomy\Strengths	20
Content\Familiarisation with bioeconomy\Challenges	14
Content\Reflection on bioeconomy	10
Content\Reflection on bioeconomy\Methods & Tools	9
Content\Reflection on bioeconomy\Strengths	7
Content\Reflection on bioeconomy\Challenges	0

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Codes used	Frequency of Attribution
Content\Hands-on experiments	8
Content\Hands-on experiments\Methods & Tools	9
Content\Hands-on experiments\Strengths	12
Content\Hands-on experiments\Challenges	12
Content\Co-Design of Ideas	19
Content\Co-Design of Ideas\Pilot Ideas	43
Content\Co-Design of Ideas\Methods & Tools	22
Content\Co-Design of Ideas\Strengths	6
Content\Co-Design of Ideas\Challenges	7
Content\Idea evaluation/selection	14
Content\Idea evaluation/selection\Methods & Tools	14
Content\Idea evaluation/selection\Strengths	3
Content\Idea evaluation/selection\Challenges	7
Content\Experimentation with pilots/project presentation	25
Content\Experimentation with pilots/project presentation\Methods & Tools	19
Content\Experimentation with pilots/project presentation\Strengths	15
Content\Experimentation with pilots/project presentation\Challenges	12
Content\Experimentation with pilots/project presentation\Project completion	7
Content\Experimentation with pilots/project presentation\Final projects/products	10
Content\Project evaluation	8
Content\Project evaluation\Methods & Tools	9
Content\Project evaluation\Strengths	7
Content\Project evaluation\Challenges	5
Phase	0
Phase\Before the workshops	3
Phase\Workshop 1	21
Phase\Between Workshop 1 & 2	9
Phase\Workshop 2	22
Phase\Between Workshop 2 & 3	10
Phase\Workshop 3	27
Phase\After Workshop 3	18
Phase\Workshop 4	4
Phase\After Workshop 4	5
Setting	0
Setting\Face-to-face	8
Setting\Face-to-face\In school	19
Setting\Face-to-face\other venue	1
Setting\Online	4
Setting\Online\partial participation	2
Setting\Online\full participation	2
Roles	3

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Codes used	Frequency of Attribution
Roles\Informant(s)	5
Roles\Co-creators	7
Roles\Collaborators	3
Roles\Tester(s)	0
Stakeholders	3
Stakeholders\Students	16
Stakeholders\Students\age group 1 (4-8) (+)	52
Stakeholders\Students\age group 2 (9-13)	33
Stakeholders\Students\age group 3 (14-19)	22
Stakeholders\Teachers	71
Stakeholders\Parents/carers	34
Stakeholders\Closer community	26
Stakeholders\General community	3

Table 1: Code tree used by ZSI for analysing Living Lab reports

In total, 1308 text segments were coded in this process. The coded segments were analysed code by code and summarised. This approach ensured that comparisons could be made both within single Living Labs, as well as across different countries and age groups, illustrating both the heterogeneity of approaches and processes as well as shared processes and results.

The results of this qualitative content-based analysis of all Living Lab reports can be found in the following section.

4.2 Results

4.2.1 Participants

4.2.1.1 Role of pupils/students

In general, the participants of the Living Labs across all countries and all age groups were pupils and took on two main roles:

1. **Co-creators**:
   "*In essence, all the actors directly involved in the Living Labs, the children and young people and the teachers, and where possible the parents, are the co-creators. Together, they come up with the ideas for their 'projects', decide on the ideas they would like to pursue further and finally jointly produce the prototypes. Nyström et al. (2014) describe a co-creator as a user who 'co-designs a service, product, or process together with the other Living Lab actors'.*" (see Chapter 2.2.3 of the GenB Living Labs guideline in Appendix 7.1 of this deliverable).
   a. In all three countries the participants took this role as considering their projects and products it can be said that all the participants were co-creators because they jointly came up with their project ideas and then collaboratively brought them to life.

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2. **Testers:**
   *"After the ideas are turned into products, services, processes etc., 'testers' who are essentially the group to which these products are intended, test them in their real-life environments. In the context of the GenB Living Labs these will possibly be the co-creators' peers e.g., the rest of the school community, their parents/families or other groups within their communities." (*see Chapter 2.2.3 of the GenB Living Labs guideline in Appendix 7.1 of this deliverable*).*
   a. In **Italy**, where there was a lot of iterative prototyping, the students also acted as testers after the prototypes had been developed by the GenB staff according and after the discussion with the participants. The latter tested and provided feedback from this exercise, enabling the creation of the final prototypes to be tested by the wider public in the final workshops.

   b. In **Slovakia**, the projects and products of the Living Labs with 4-8-year-olds and 9-13-year-olds were created in groups, just as those in the Living Lab with 14-19-year-olds in **Austria** and as such, the during the final workshops, the participants within the Living Labs acted as testers for each other. This was also the case with the final workshops of the 4-8 and 9-13-year-olds in Austria where the participants of the different Living Labs acted as testers for each other.

Outside the Living Labs participants, pupils were involved in the experimentation phase in all the Living Labs as testers i.e., people who test the projects and products in real life environments. In the Living Labs with 4-8-year-olds and 9-13-year-olds in Austria, other pupils from the school who were not part of the Living Labs attended the final workshop. These are essentially the primary target groups of the products and projects created. In the Living Lab with 14-19-year-olds, the group that implemented the project of educating elementary school pupils on the bioeconomy also involved the target group, the children that were taught, as testers.

Like in Austria, other children not part of the Living Labs were also involved as testers during the final workshops of all the Living Labs in Italy that took part in the context of bigger events with the presence of students as well as with the final workshop of the Living Lab with 14-19-year-olds in Slovakia which took part as a part of an exhibition in the leisure centre with the presence of visitors, peers and families. During the testing phase with people outside of the Living Labs, the participants of the Living Labs took on the role of "experts" for parents, citizens and teachers who tested the games.

4.2.1.2 Roles of GenB staff

4.2.1.2.1 Austria

In Austria, ZSI staff purely took on a facilitation role in all the Living Labs. This involves organising the workshops, educating the participants on the bioeconomy as well as any methodologies that might facilitate their Living Lab process e.g., elevator pitch in the Living Lab with 14-19-year-

olds, giving the participants the tools for co-creation and answering any questions on the process; in general, ensuring a conducive learning atmosphere. At the second workshop which was station-based, three of the stations were manned by ZSI staff and the last one by the class teachers. In the second workshop of Living Lab with 14-19-year-olds, ZSI staff were present in the room to answer any questions and provide clarifications during the exploration phase, however, the pupils were left to run the discussions on their own to get a sense of ownership of the process.

4.2.1.2.2 Italy

In the Living Labs with 4-8-year-olds and 9-13-year-olds in Italy like in Austria, the APRE staff organised the workshops, educated the participants on bioeconomy and facilitated the co-creation phase. Once the ideas from the class had been collected, they were further elaborated (revised, fine-tuned, standardised) by APRE staff after the end of the second workshop in order to produce a final prototype to be tested. At the same time APRE staff ensured that the needs, preferences, tastes of students were taken into consideration in the whole process (e.g., colours of the board, ideas on the participants of the game, ideas on the content of the questions and activities of the game). Furthermore, APRE staff constantly assessed the goodness of the ideas in relation to scientific validity. Staff from APRE also proposed presentation methodologies of the game for the experimentation phase, e.g., they created a rhyme which the participants were allowed to improve and required to memorise for the final workshop, suggested materials to be presented during the final workshop i.e., handicraft processes and contents, however in this case the pupils preferred using their own elaborated material rather than the proposed solutions form the APRE team. In the group discussions, at least one GenB staff was involved to ensure positive discussions where all participants have the chances to air their opinions and ideas and that these are taken seriously by the group.

With regards to the Living Labs with 14-19-year-olds in Italy, FVA also took on the role of organising and moderating the workshops and educating the pupils on the bioeconomy. Additionally, FVA staff were also actively involved in all the phases of the Living Labs before the experimentation stage, namely ideation and exploration. In collaboration with the teachers and students and the FVA team, the decision to create the escape game was made. In a follow up to this, the FVA team provided the participants information on how such a game is developed and together with the teachers and students, they defined the concept in finer details in the prototyping stage in preparation for testing. In addition to providing the participants with examples of other existing escape games, the FVA team also provided them with tips about how to design quizzes and enigmas and also provided them with templates and useful links to facilitate students in having clear references when developing the game further. Furthermore, the FVA technical team developed some quizzes for the game that are to use an online platform while the game itself will be in physical format.

4.2.1.2.3 Slovakia

In the Living Labs with 9-13-year-olds and 14-19-year-olds, staff from PEDAL took a facilitating role like the counterparts in Austria: i.e., organisation of the workshops, moderating the workshops, education on the bioeconomy and also other topics related to sustainability and climate change, empowering the participants with different methodologies to support them with the process e.g., storytelling and design-thinking methodologies. In the Living Lab with 4-8-year-olds, presumably due to the challenge of the young children to make a decision (this is deduced from the report which mentioned "due to the age of the participants"), PEDAL staff together with the class teacher decided on the format of the projects to be created by the group after a portfolio of ideas from the participants had been collected. The participants were then free to select the topics of their "books". From this point on, there is no indication that the staff from PEDAL were very highly involved in the development of the final products.

4.2.1.2.4 Commonalities and strengths

1. **Workshop organisation**: GenB staff in all locations were responsible for organising workshops.

2. **Education on bioeconomy**: GenB staff in all Living Labs across the three countries were responsible for educating participants about the bioeconomy.

3. **Facilitation role**: Across all age groups in Austria and in the Living Labs with 9-13-year-olds and 14-19-year-olds in Slovakia, GenB staff primarily took on a facilitation role; meaning no direct involvement in the ideation and prototyping phases by only moderating the workshops. They organised workshops ensuring conducive learning environments, provided information on the bioeconomy, and educated participants on methodologies to facilitate the Living Lab process. In the Living Lab with 4-8-year-olds in Slovakia, PEDAL together with the teacher decided on the format to be created by the participants, who then could decide on the topics freely. In Italy (all Living Labs), GenB partners were more actively involved in the ideation stage and prototyping phases.

4.2.1.2.5 Disparities and complexities

1. **Idea elaboration**: In Italy across all the Living Labs, GenB staff elaborated on the ideas collected from the participants. In Austria and Slovakia, GenB staff did not play a significant role in the development of the ideas with the exception of the selection of the format in the Living Lab with 4-8-year-olds in Slovakia, which was done by PEDAL staff in collaboration with the class teacher.

2. **Product development**: in all the Living Labs in Italy, GenB staff actively participated in the development of the concepts i.e., board game and escape game, whereas in Austria and Slovakia, staff involvement in final product development was limited.

3. **Collaboration with external organisations**: In Austria and Italy the main collaboration took place directly between the organisation involved in GenB and the schools. In Slovakia the collaboration went even further with the involvement of the educators from the leisure centre not only to reach the target group, but also to implement the workshops.

4. **Youngest age group**: In Slovakia, GenB staff along with the class teacher made the decision about the format that the participants would develop further. This was not the case for this age group in Austria and Italy. Noteworthy is that both the 4-8-year-olds and 9-13-year-olds in Italy ended up working on the same idea. In the reporting templates it is unclear how this came to be and could be a similar situation to Slovakia's approach.

5. **Scientific validity assessment**: In the Living Labs with 4-8 and 9-13-year-olds in Italy, GenB staff assessed the ideas of the participants in terms of scientific validity i.e., if the ideas from the participants were in line with the concept of bioeconomy. In Austria this was not the case and in Slovakia and for the Living Lab with 14-19-year-olds in Italy, the workshop documentation does not indicate the involvement of GenB staff in this endeavour.

6. **Facilitation of discussions**: In all the Living Labs in Italy, it was standard practice to have at least one GenB staff member actively participating in group discussions. This approach was aimed at ensuring a positive and inclusive atmosphere within the discussions, promoting productive exchanges among participants. In contrast, in Austria, similar discussions only occurred during the second workshop of the Living Labs involving 14-19-year-olds. It was a deliberate choice to allow the participants to lead these discussions independently, as staff involvement during these discussions might have hindered the open exchange of ideas and this was expected to encourage the participants to take ownership of their ideas. In Slovakia the situation was similar to Italy. Time for discussions was dedicated in all workshops. The discussions were facilitated by the GenB staff, encouraging participants to provide feedback, additional ideas or insights. Teachers were present, supporting the GenB team.

4.2.1.3 Roles of teachers/educators

From the onset, teachers were integral parts of the Living Labs as they provided access to the pupils and were instrumental in managing the Living Labs, leading the activities of the Living Labs between the workshops and acting as an intermediary between the GenB project partners, the pupils and their parents (see Chapter 2.2. of the GenB Living Labs guideline in Appendix 7.1 of this deliverable).

4.2.1.3.1 Austria

In Austria, the class teachers were an important element of all the Living Labs for the following reasons:

- They accompanied the pupils in the Living Labs workshops and also took part in them by assisting the moderators in explaining some elements in a language that "their children" understood better and also by bringing in examples that they knew would resonate with the pupils. Furthermore, they also intervened once group dynamics got slightly out of hand.

- With the teachers in the Living Lab with 14-19-year-olds, the teachers took more of a supportive role and did not directly take part in the projects. They were there to answer the students' questions, help them with coming up with ideas if stuck or giving them feedback on their ideas, reminding them of the different deadlines and any exercises they needed to do and arranging the room for the workshop.

- They supported and encouraged the pupils in the periods between the workshops in terms of ideation and prototyping and preparing for the final workshops. They ensured that the pupils had completed the assignments they were set for each workshop by setting time aside in the curriculum to complete these.

- Encouraged the pupils to share the experiences of the Living Labs with their families through targeted assignments.

- Supported the implementation of the second workshop by manning the memory game station. [Living Lab with 4-8-year-olds and Living Lab with 9-13-year-olds]

- With the younger children, who were a bit shy, the teachers presented the ideas that they had discussed. From the presentations it was obvious that the ideas were not the teacher's but stemmed from the children.

- In the second workshop that required working in groups, the class teachers took over the grouping, what in most cases seemed to be an existing system, to ensure that the mix of students was good as they knew them better and therefore knew who could work with who etc. Only the very young pupils were divided somewhat randomly into the groups by the class teachers. Assumedly, because they were all in the first semester of the first year in school, they were still very shy, and these groups also worked very well together as there were no observable cliques.

- In some cases, where the teachers were very motivated, it seemed that a lot of products were created possibly from the suggestion of the teacher. Nevertheless, even such cases there was at least one product that was created by the whole class. Furthermore, these teachers explicitly expressed interest to continue working with their classes on the topic in the following school year.

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- In one particular case, the teacher seemed at uncertain about the process and especially if there was enough time to create the products. The project idea discussion that took place in the second workshop was very interesting and the children shared some very interesting and creative idea. However, at the final product, in this case the flowerpots from tetra packs and fabric remnants were quite minimalistic. [Living Lab 2 with 4-8-year-olds]

- Providing feedback on the Living Labs process.

- Providing materials for the workshops and experiments e.g., flipcharts, creating bioplastic from orange peels.

- Supporting in conducting the experiment creating bioplastic. For instance, the microwave necessary for cooking the orange peel mass was in the teachers' room and not in the classroom. So, the teacher went up and down twice to put it in the microwave. [Living Lab with 14-19-year-olds]

In addition to the class teachers, there were also two other teachers who played an integral part in the implementation of all the Living Labs in Austria, namely, the "intermediary" teachers. The Living Labs with 4-8-year-olds and 9-13-year-olds took place in one school and that with 14-19-year-olds in another school. In each school there was a teacher who organised the implementation of the Living Labs in the school therefore acting as intermediaries between the schools and ZSI staff. ZSI staff contacted and explained the concept to them and they in turn brought this up to the school administrations and the other teachers. They ensured that the class teachers were well informed about when each of them would need to be in the workshop room with their class. The intermediary teacher especially in the school with the younger age groups also popped in and out of the workshops to check whether everything was in order and exuded a positive energy also to the pupils as she is familiar with all of them as a teacher who supports pupils with special needs directly in the different classes.

Teachers and other school staff that were not part of the Living Labs took part in the final workshop of the Living Labs with 4-8-year-olds and 9-13-year-olds.

4.2.1.3.2 Italy

The role of teachers in the Living Labs with 4-8-year-olds and 9-13-year-olds in Italy can be summarised as follows:

- The teachers in these Living Labs did not participate actively in the implementation of the workshops and mainly delegated related activities to APRE staff. However, APRE maintained constant communication and gave clear instructions to them prior to each workshop, which worked well.

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- Teachers demonstrated awareness and interest in the bioeconomy topic and were interested in being "promoters" and key actors (ambassadors) of the bioeconomy, contributing to raising awareness among other multipliers.

- Teachers played a crucial role in keeping students' attention during the workshops.

- Like in Austria, they also managed dividing the participants into groups during the activities.

- They were also involved in addressing critical moments in group discussions by balancing group dynamics which were related to students talking on top of each other or having groups which were more active and engaged than others, according to the activities of their interest. This was addressed through teachers' facilitation role (e.g., composing groups in a more equilibrated manner), and also placing one APRE staff as facilitator of each group, putting attention on including all students in the activities and being attentive to their needs, preferences, tastes etc.

In the Living Labs with the 14-19-year-olds, the role of teachers was broader:

- Teachers actively contributed to developing the product, escape game, within and outside the workshops together with the students.

- In the third workshop, the teachers represented the students during an additional online meeting because some students were busy with high school exams and the school had already closed for the summer break. In September and October 2023 additional online meetings were organised to finalise the material for the escape game, involving both teachers and students.

- Teachers were involved in selecting students for the Living Lab based on their expertise and contributions to the project.

- Teachers' presence during training sessions provided by the FVA team helped connect the Living Lab activities with the school program. This ensured that students could build connections with previous experiences and integrate new knowledge. They collaborated with the FVA team to align the Living Lab activities with the educational program and create effective educational formats.

- Teachers played a vital role in resolving organisational issues, such as the distance from Rome to the school, by offering the online option.

Like in Austria, one teacher, made the link between the school and FVA to enable the implementation of the Living Lab within the school. In addition to this, she aligned the Living Lab activities with the existing educational program. She also selected the participants of the Living

Lab based on the stage of the students' school careers and previous experiences, to make sure they can produce a more solid and innovative educational format. This was the case for the teachers involved; she selected the other teachers involved based on their experience, topics of teaching and possible contribution to the Living Lab. She took part in preparatory meetings with FVA where she was able to share the knowledge of the students specifically with regards to bioeconomy and sustainability and understand how to better design the educational activities foreseen in the Living Labs.

4.2.1.3.3 Slovakia

The Living Labs in Slovakia were implemented in collaboration between PEDAL (GenB partner) and the Gessayova leisure centre. The staff at the leisure centre supported PEDAL in reaching the teachers and pupils and also supported the active implementation of the workshops as they too are educators.

Besides the educators being present in all the workshops, so were the class teachers of the pupils in all Living Labs in Slovakia and their role can be summarised as follows:

- A teacher who was enthusiastic and supportive of green topics played a vital role in the success of the Living Lab. This teacher actively facilitated the process and expressed interest in continuing cooperation in the future.
- The teacher actively participated in the Living Lab, supporting the workshops, and ensuring a conducive learning atmosphere.
- The teachers' active participation and support were crucial in maintaining discipline and focus during the workshops.
- The teachers also played a key role in bridging the methodologies used in the Living Lab with the students' existing learning experience, ensuring a seamless integration of the content into regular classes.
- Teachers played a crucial role in the Living Lab process by providing support and guidance to the students within and outside the workshops.
- They actively collaborated with the students, encouraged their creativity, and contributed to the visualisation of the project.
- The active involvement of teachers contributed to student engagement and commitment to the project. The Living Lab provided a platform for students to work collaboratively, fostering group dynamics and leadership among students.
- Teachers played a significant role in guiding and encouraging the students' ideas, while also being open to incorporating students' preferences and suggestions.

- The Living Lab's collaborative approach fostered a sense of ownership among students, enabling them to take the initiative and drive their own learning. Overall, the involvement of different groups, especially the dedication of students and support from teachers, created a fruitful environment for the success of the Living Lab and its creative outcomes.

- Additional teachers were successfully involved to the process, providing support in creating visualisation s and enhancing project development.

- Together with PEDAL the class teacher fixed the format of the projects that the Living Labs with 4-8-year-olds could produce possibly due to their young age and with limited time taking a decision that is feasible would have been challenging.

4.2.1.3.4 Commonalities and strengths

1. **Teacher support for group activities:** In Austria, Slovakia and Italy, teachers played a role in dividing participants into groups during the activities. In all countries, the teachers present also addressed issues related to group dynamics, ensuring that all students were actively engaged in the workshops.

2. **Support for ideation and prototyping:** Teachers in all three countries encouraged students to ideate and prototype their ideas, both within and outside the workshops. They helped students with their creative processes.

3. **Integration with school curriculum:** Teachers in Austria, Italy, and Slovakia ensured that the Living Labs' activities were aligned with the school curriculum. They integrated the content into regular classes, connecting previous experiences with new knowledge.

4. **Role in Organisational Matters:** Teachers in all three countries played roles in resolving organisational issues related to the Living Labs, such as selecting participants, arranging logistics, and facilitating communication between schools and external organisations.

5. **Interest in the bioeconomy topic**: Teachers in Austria, Italy, and Slovakia showed an interest in the bioeconomy topic and were interested in promoting it among students. They saw themselves as key actors in raising awareness about the subject.

4.2.1.3.5 Disparities and complexities

1. **Active participation in projects**:
    a. In Austria, teachers actively participated in project development, sometimes suggesting ideas and contributing to product creation, especially in the case of motivated teachers.

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b. In Italy, teachers in the Living Labs with 14-19-year-olds actively contributed to developing the escape games, both within and outside the workshops. They played a more hands-on role in project development.
c. In Slovakia, a teacher who was enthusiastic about green topics played an active role in the Living Lab's success. The teachers supported the team mainly in organisational issues - e.g., dividing students into groups (4-8, 9-14) and ensuring the group work continues between the workshops (age group 14-19).

2. **Role in workshops**:
    a. In Austria, class teachers were actively involved in workshops with 4-8-year-olds and 9-13-year-olds, assisting moderators, helping with group dynamics, and ensuring assignments were completed. With 14-19-year-olds, they took a more supportive role.
    b. In Italy, teachers in Living Labs with 4-8-year-olds and 9-13-year-olds mainly delegated workshop activities to APRE staff but played a more active role in the Living Labs with 14-19-year-olds.
    c. In Slovakia, class teachers were actively involved in all Living Labs, helping maintain discipline, facilitating learning, and integrating methodologies with regular classes.

3. **Representation of pupils in workshops**: In the Living Lab with 14-19-year-olds in Italy, teachers represented students during an additional online workshop because students were busy with exams. Nevertheless, the large number of workshops and meetings organised ensured the active participation of all students involved in the Living Labs.

4. **Selection of Participants**: In Italy, teachers in the Living Labs with 14-19-year-olds were involved in selecting students based on expertise and potential contributions to the project.

5. **Teachers' roles beyond the Living Labs:**
    a. In Austria, intermediary teachers acted as liaisons between schools, ZSI staff and class teachers ensuring communication and organisation.
    b. In Slovakia, staff at the leisure centre supported the Living Labs and at the beginning, liaised between PEDAL and the schools as well as took an active part in the implementation of the workshops. The class teachers played an active role in facilitating the process.
    c. In Italy the Living Labs were organised as part of the official activities of the schools involved and therefore the teachers played a central role in integrating the Living Labs in the educational offer to the students. Additionally, for the Italian Living Lab with 14-19-year-old, the teachers facilitated the exploitation of the escape game as one of the key activities in the city's festival of science.

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6. **Directing project idea selection**: In Slovakia for the Living Lab with the 4-8-year-olds, due to their age the teacher together with the staff from PEDAL defined the format that the pupils should produce, "books", however the topics were left up to the pupils.

4.2.1.4 Roles of parents and families

Although, it was hoped that parents would be involved in all three workshops directly, this was not possible as in all countries the workshops took place during the normal school hours where most parents had other obligations like work.

4.2.1.4.1 Austria

In Austria no parent participated in any of the workshops of the Living Labs (all age groups) directly although this was the initial intention. Nevertheless, the moderators encouraged the participants to involve their parents and families in the period between workshops by on one hand actively telling them about their workshop experiences and on the other hand, by encouraging them to consult their families on their ideas so as to get feedback to improve their projects or get assistance in bringing their projects to life. This was not only done in official presentations at the workshop, but the moderators also actively took advantage of the discussions to encourage dialogue between the participants and their families on the topic and also on the Living Lab process. As an example, it was suggested to one of the pupils with a new baby brother to ask her mum whether she knew how many diapers her brother uses in a year – something that came up from the "What's bioeconomy?" book.

One of the class teachers of the youngest pupils involved in the Living Labs with 4-8-year-olds (first graders) also assigned homework that required parental participation: Each pupil was given an A3 paper with the following assignment printed on it: "What can I make out of existing materials, bio-based materials or waste, without having to buy it? Look at the 'What is bioeconomy book?' with your parents and talk about it".

Some participants of the Living Lab with 9-13-year-olds who produced educational videos as one of the outputs of their Living Labs involved their parents in the video. In some of the videos their parents can be seen as one of the "actors" or their voice, part of the video script, can be heard. Furthermore, there was evidence that the parents of the participants were involved in the development of some of the projects of the participants from the Living Lab with 4-8-year-olds, namely the pencil case from recycled plastic bottles.

Furthermore, although many attempts were made to open up the final workshop with 4-8-year-olds and 9-13-year-olds to the general public, measures that had been placed during the Covid-19 pandemic prevented this. Nevertheless, the exhibition that was set up for the final workshop was left open and the families including parents, siblings and other family members of the participants as well as other people from the locality who were not involved were able to visit it during the school simmer festival that took part a few days later.

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For the Living Lab with 14-19-year-olds in Austria the involvement of parents was similar as with the two younger age groups. Their involvement was only indirect through the participants telling them about the workshops and their projects. This was confirmed in the evaluation session where one of the questions that was asked was with whom they communicated about the topic, Living Lab process and their projects. Many answers indicated that some participants had interestingly shared this information with their mothers. Fathers were not mentioned. Additionally, siblings were mentioned, and one participant even went as far as to explain the level of involvement of her brother, namely the technical side of creating the videos. The educational videos created are planned to be displayed around the school and on the school website which will give the participants' families a chance to learn more about the process and products created by their children.

4.2.1.4.2 Italy

Like in Austria, in Italy it was also the intention to involve parents continually in the process, however this turned out to be quite challenging due to timing of the workshops and parents' other obligations such as work. As a result, similar to Austria the workshop moderators set assignments that required the participants to actively engage their parents. At the first workshop of the Living Lab with the Living Labs process for the 4-8-year-olds and 9-13-year-olds, the participants were given the assignment of involving their parents to take photos and videos in their homes and neighbourhoods of places where biomass from waste is produced and of bio-based products.

In addition, the final workshop of the Living Labs process for the 4-8-year-olds and 9-13-year-olds took place in the framework of the "sustainability day", an annual open school event, where the general public is invited – on this occasion, therefore, the parents and families in general were directly involved as the they attended this event and tested the game in the experimentation phase of the Living Labs. After playing the game all the visitors including parents were requested by APRE to complete an online questionnaire to give their feedback on the game. It was noted that parents suggested making the questions simpler for younger children and reducing the activities needed to complete the bio-based product within the game.

In the Living Lab with 14-19-year-olds the situation of involving parents was the same. It was not possible to involve them during the design phases. However, they will participate in the final events in which also the external audience (not directly involved in the Living Lab) will be involved in the experimentation of the escape game.

4.2.1.4.3 Slovakia

In Slovakia the involvement of parents was somewhat more promising. In the Living Lab with the 4-8-year-olds, three parents accompanied the children to the second workshop and a

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number of parents also attended the final workshop of the Living Labs process with this age group.

More involvement of parents was intended like in the other two countries and as a result, the participants of the Living Lab with 4-8-year-olds and that with 9-13-year-olds were encouraged to actively seek the feedback from their parents on the products they were creating and build in the feedback in the creation process as well as share their experiences of the Living Labs process.

For the Living Lab with 14-19-year-olds the participants were also encouraged to involve their parents in a similar way like the younger groups: to share their experiences of the process and get feedback and ideas on and for their product. It was noted that for this group other than the fact that the parents would have time restrictions to attend the workshop, the participants preferred working with their peers and teachers. Although the final workshop took place at the leisure centre, where a larger audience including parents was expected. The parents of the participants in this age group did not attend.

4.2.1.4.4 Commonalities and strengths

1. **Intention to involve parents:** In all three countries, there was an initial intention to involve parents in the Living Labs workshops.

2. **Sharing workshop experiences:** Participants in all three countries and all age groups were encouraged to share their workshop experiences with their families and involve them in discussions related to the Living Lab projects. This sharing was seen as a way to encourage dialogue and gather feedback.

3. **Assignments for parental involvement:** When direct parental participation was not possible due to scheduling or other constraints, workshop moderators in Austria and Italy set assignments for the participants that required them to actively engage their parents. This encouraged indirect involvement.

4.2.1.4.5 Disparities and complexities

1. **Level of parental involvement**:
   a. **Austria**: In all the Living Lab works in Austria, parents were indirectly involved in the periods between the workshop. Direct involvement was possible at the exhibition at the summer; however, this was not part of the official Living Labs process, i.e., it took place after the last workshop.
   b. **Italy**: In Italy the situation was similar to Austria with the main difference being that parents were able to participate in the last workshop of the Living Labs process for all age groups.

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c. **Slovakia**: Slovakia is the only country that had direct parental involvement before the final workshop. This was only for the Living Lab with the youngest age group. Unfortunately, although parental participation was theoretically possible at the last workshop with 14-19-year-olds, no parents attended. Nevertheless, between the workshops the participants were encouraged to share their experiences and seek feedback on their projects from their parents.

2. **Events for parental involvement**: The last workshops were planned to be open for a wider audience (see Chapter 3.1.1.2.6 of the GenB Living Labs guideline in Appendix 7.1 of this deliverable). Unfortunately, in Austria it was not possible to engage a much wider audience that the school community for any of the Living Labs. In Italy, the final workshops for all Living Labs were open to the general public hence allowing a wider audience to test the projects and products of the participants. In Slovakia, this was only possible for the Living Labs with 4-8-year-olds and 14-19-year-olds, nevertheless the parents of the latter age group did not show up.

3. **Specific assignments**: In Austria, there were specific assignments given to parents, such as discussing bioeconomy topics with their children or helping with homework. In Italy, parents were involved in taking photos and videos related to biomass and bio-based products. Slovakia encouraged feedback and involvement but did not mention specific assignments for parents.

4.2.1.5 Role of the general community

The involvement of the general community in GenB Living Labs was only foreseen in the experimentation stage, where the participants' products and projects would be tested with the target community to determine whether they suited their aimed purpose or required alterations to meet the expected objectives. Therefore, if at all, the general community would have participated in the final workshops of the Living Labs.

4.2.1.5.1 Austria

In the Living Labs with 4-8-year-olds and 9-13-year-olds in Austria none of the products directly targeted the general community but were rather targeted to peers. Nevertheless, as these were all awareness raising tools on the bioeconomy it was deemed beneficial to also involve the general public at some point. The intention was to do this at the final workshop. However, due to measures that had been implemented during the Covid-19 pandemic it was not possible to open up the workshop to the general public, nevertheless, the exhibition prepared for the final workshop was left standing and visitors of the school's summer festival, which took place a few days later had an opportunity to visit it. As the exhibition was not manned, it was therefore not possible to gather the visitors' feedback on the products and projects.

For the Living Lab with the oldest age group, one of the projects created was targeted towards the restaurant and retail food industry: Advocacy on sustainable packaging targeted. As the project was in form of a letter to the heads of different supermarkets, it would have brought added value to get feedback from people from the industry or lobbying and communication on how to formulate it so as to have maximum impact. Unfortunately, as the final workshop took place during the normal teaching hours in a school classroom and since there was not a lot of time in between the finalisation of the project and this workshop it was not possible to invite a wider audience to the workshop. Nevertheless, members of the target group, specifically the people who received the communication were involved indirectly. The project on educational videos also directly and indirectly involved the target groups just not at the final workshop. For example, a video about food packaging that highlighted a zero-waste grocery store involved the participant visiting the store and engaging with the staff at the store about the topic during the filming process.

4.2.1.5.2 Italy

In Italy, the last workshop of the Living Lab with 4-8-year-olds and that with 9-13-year-olds took place in the framework of the annual "sustainability day" at the school which is open to the general public. As a result, in this case there was direct involvement of this group of stakeholders. Although the primary target group of the game produced by the two Living Labs jointly, the board game, is targeted towards children between the age of 8 and 13, the game can also be played with adults. As a result, during this workshop members of the public were able to test the game and provide their feedback.

Additionally, after the Living Lab process for the two younger age groups in Italy, APRE invited experts to a focus group (without the participants) to discuss the game developed by the students. In this case, the feedback from the experts (including experts from academia, industry, scientific dissemination, education and gaming) will be taken account into the final game production by the APRE team.

The final workshop of the Living Lab with 14-19-year-olds in Italy took place in the framework of two large-scale events namely, Maker Faire in Rome (on 20/10/2023) and Fermhamente in Fermo (on 22/10/2023). The escape game stemming from the Living Lab was played by groups of students, parents and teachers, in different slots to validate and test the game and finally collect feedback. At Maker Faire the escape game was played 5 times involving around 50 youngsters above 14 years old and 5 parents/adults supporting them throughout the experience. In Fermhamente the escape was played 5 times by around 80 youngsters with their parents and teachers, in a more simplified version. The latter was more similar to an experiential learning game rather than a proper escape game, because the age of the participants was very heterogeneous, involving also primary school students and the enigmas and quizzes were too complex for them. The escape game was in fact designed targeting mostly teenagers and young adults.

4.2.1.5.3 Slovakia

The final workshop in Slovakia for the three age groups was planned in collaboration with the Gessayova Leisure Centre. Participants of all three Living Labs were expected to present their projects and products in this workshop. Unfortunately, due some unexpected circumstances (health issues on the side of the leading teacher of the primary group, a-week long school trip of the elementary group), only the high school students could participate and a few primary group students with their parents. As a result, at this workshop, that took place during an exhibition organised by the Gessayova Leisure Centre only the board game created by the Living Lab with 14-19-year-olds was presented to a broader audience involving visitors, parents, and other students.

The final workshop of the Living Lab with 4-8-year-olds took place in the classroom a week after that of the 14-19-year-olds as due to the health problems of the teacher and end-of-year school trips, the pupils did not have time to prepare their work before the planned joint experimentation during the event organised by the Gessayova Leisure Centre (15.6.2023). Like with the final workshop of the Living Lab with 4-8-year-olds, that with 9-13-year-olds took place in the classroom after the planned event where the 14-19-year-olds had their final workshop. Although only the other participants of the same Living Lab were in attendance in each case, and in essence they were the target group of the projects as peers, and the fact that the Living Lab had realised a number of different (comic) “books” and posters in groups, the audience was able to give valuable feedback for the products.

4.2.1.5.4 Commonalities and strengths

1. **Challenges due to constraints**: Austria (all age groups) and Slovakia (4-8 and 9-13) faced challenges that limited their ability to involve the general public directly such as Covid-19 measures in Austria and scheduling conflicts in Slovakia.

4.2.1.5.5 Disparities and complexities

1. **Structured approach to involving the general public**: Italy had a more structured approach with regards to involving the general public, with the final workshops for all Living Labs coinciding with specific events like the "sustainability day," and participation in large-scale events (Maker Faire and Fermhamente).

2. **Validation of product by experts**: Only in Italy was the product produced collaboratively by both the Living Labs with 4-8-year-olds and 9-13-year-olds, the board game, validated by a team of experts even if this took part after the Living Labs process and in the absence of the participants of the Living Labs.

4.2.2 Invitation

In all three countries, the invitation of the Living Lab participants was based on building on already existing contacts. For the Austrian primary and elementary Living Labs private contacts of a ZSI colleague were used: One of the ZSI colleagues, who is part of the internal bioeconomy working group, connected the ZSI employees working on the GenB project to a teacher in the Südstadt primary school, who she knows through both their children. The teacher was interested in the topic and coordinated with the school administration and other teachers to implement the GenB Living Labs in the school. ZSI staff had direct contact to this teacher who acted as an intermediary between ZSI and the school administration, teachers and pupils. At the end, all the class teachers in the school except for two classes, who lacked time, decided to take part in the GenB Living Labs. As a result, in Austria two Living Labs for the age group of 4-8 and one for 9-13 were implemented in this school [Austria, ZSI, WS1, 4-8 and 9-13-year-olds].

Also, for the Austrian high school Living Labs, private contacts of a ZSI colleague led to the successful cooperation. The ZSI GenB team was connected to a science teacher at the High School AHS am Augarten. The teacher was interested in the topic in general but was quite critical concerning a too positive representation of bioeconomy and also had some concerns regarding its sustainable use. In a phone call before the implementation, it was agreed to communicate the topic with a critical view, giving the students also food for thought. She proposed to involve students of the 7th grade in the Living Lab, for which she is teaching the subject “human and environment”. Additionally, she also engaged her colleague, who is teaching the subject “human and environment” for the other part of the 7th graders. Within this subject, the students were learning about food and hence the focus was introducing the concept of bioeconomy and its relation to food and food waste [Austria, ZSI, WS1, 14-19-year-olds].

In Italy, APRE collaborated with a primary school that was already involved in activities of the project Transition2Bio and thus an already existing collaboration could be prolonged. The school was chosen for the creativity, good practices and sensitivity towards certain sustainability issues and because of the already existing trusting relationship with involved teachers. For inviting the school to the GenB Living Labs, APRE contacted the referent of environmental sustainability at I.C. “Guicciardini” to promote the Living Labs in the school. Two classes, one pre-early and one elementary school class, accepted to participate in the Living Labs together with their teachers [Italy, APRE, WS1, 4-8 and 9-13-year-olds].

FVA, who was responsible for the Italian High school Living Lab, had also collaborated with the ITT Montani in Fermo previously. For initiating the collaboration regarding the GenB Living Lab, FVA got in contact with one of the teachers responsible for the chemistry class [Italy, FVA, WS1, 14-19-year-olds].

In Slovakia the invitation process for all three Living Labs was initiated by establishing a collaboration with the Leisure Centre Gessayova in Bratislava, which already had partnerships with diverse schools. The Living Labs for the 4-8-year-olds and the 14-19-year-olds build on an

existing partnership between the leisure centre and the Secondary Vocational School of Pedagogy. Through this connection, the project team was able to approach teachers who were open to environmental topics and willing to participate in the Living Labs [Slovakia, PEDAL, WS1, 4-8 and 14-19-year-olds]. The invitation process for the 9-13-year-olds started with the Leisure Centre staff approaching a teacher at the Ivan Bukovčan School who was known to be open to environmental topics, even though she did not teach science or similar subjects. The teacher expressed interest in the GenB activities and was supportive throughout the process. The students invited to the workshops were from one class (grade 5, aged 9 to 11 years). As the workshop took place during school hours, the facilitators from PEDAL and the Leisure Centre were invited to hold the workshop during a class lead by this teacher [Slovakia, PEDAL, WS1, 9-13-year-olds].

Positive aspects regarding the invitation process and the following participation of the schools in the Living Lab process relied on four main aspects:

- Probably the most important factor in the invitation process were **already existing contacts** either to schools or to single persons. The Italian schools participating in the Living Labs already cooperated with APRE and FVA previously. The cooperation with Austrian schools could be achieved through personal contacts and for the Slovakian schools the collaboration with the Leisure Centre supported getting in contact with schools.
- An important advantage of all Living Labs was the **participation of whole classes**, which made the process easier for facilitators and teachers. In the Austrian primary school even the individual class teachers decided, depending on the capacity and resources, whether their classes participated or not [Austria, ZSI, WS1, 4-8 and 9-13-year-olds].
- Another advantage was that the **majority of the teachers involved were already aware of the bioeconomy**, mostly because they were science teachers had been previously involved in bioeconomy projects [Austria, ZSI, WS1, 14-19-year-olds; Italy, FVA, WS1, 14-19-year-olds; Italy, APRE, WS1, 4-8-year-olds].
- The fourth major advantage was **the enthusiasm and positive attitude of schools and especially teachers approached** for invitation. So e.g., for the Slovakian Living Labs, it was reported that the teacher's enthusiasm and support played a vital role in mobilising pupils and facilitating the workshops [Slovakia, PEDAL, WS1, 4-8 and 14-19-year-olds].

4.2.3 Living Labs set up and methods

4.2.3.1 General Setup

In Austria, Italy and Slovakia, the Living Labs were organised in an age-based manner, that is, separate Living Labs for each age group: 4-8, 9-13 and 14-19. In Austria and Slovakia, one GenB project partner each was responsible to organise the Living Labs with all three age groups – this was ZSI in the Austrian context and PEDAL in Slovakia respectively. In Italy, APRE organised the two Living Labs with the two younger age groups and FVA led the Living Lab with the 14-19-year-olds.

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With regards to the facilitation of individual Living Labs per age group, two approaches were taken – either each age group was reached at a different school, [Slovakia, PEDAL 4-8, 9-13 & 14-19-year-olds; Austria, ZSI, 14-19-year-olds; Italy, FVA, 14-19-year-olds] or different classes of the same school were engaged in the Living Labs according to their age [Italy, APRE, 4-8 & 9-13-year-olds; Austria, ZSI, 4-8 & 9-13-year-olds].

Each Living Lab consisted of a series of a minimum of 3 workshops as well as the phases in between (the Living Labs in Italy conducted four workshops for each age group while in Austria and Slovakia, three workshops per age group were implemented). Most of the Living Labs happened in face-to-face settings, with the majority being conducted in a classroom setting – only PEDAL organised Workshop 3 at their cooperating partner's facility, the Gessayova Leisure Centre [Slovakia, PEDAL, WS3, 4-8 & 14-19-year-olds] and FVA conducted the final workshop in the framework of two large-scale events. On the basis of the long distance between the cooperating school and FVA's headquarters, FVA organised workshop 2 and workshop 3 of their Living Lab with 14-19-year-olds online and also conducted additional online meetings in between to fine tune and finalise the product.

Correspondingly, the timing of the different Living Labs was aligned with their locations. For instance, ZSI organised the Living Labs with 4-8-year-olds and 9-13-year-olds in a chronological way, with the groups participating in different workshops, which happened, however, sequentially one after another on the same day [Austria, ZSI, WS1-3, 4-8 & 9-13-year-olds]. With the youngest age group (4-8-year-olds), ZSI in Austria organised two Living Labs each due to the high number of participants. In Slovakia two classes were involved in the Living Lab with 4-8-year-olds. The teacher of one of the two classes was not able to pursue the engagement beyond workshop 2 [Slovakia, PEDAL, WS1-3, 4-8-year-olds], therefore only one class with 4-8-year-olds in Slovakia existed throughout the process.

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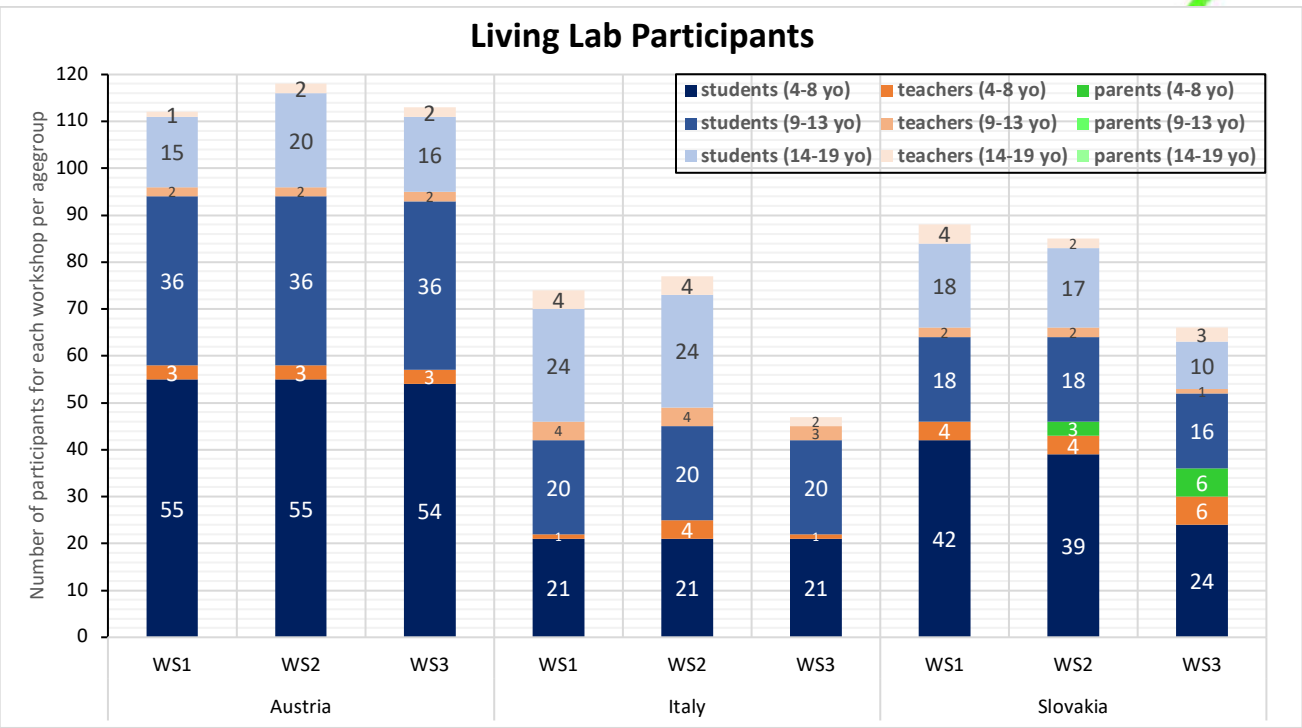

Figure 1 - Living Lab participants across the workshops, students per age group (yo = year old) in blue colours, teachers in orange and parents in green colours. The same colour within the three workshop rows of one country represents the same group.

Figure 1 illustrates the number of participants per age group, per workshop and per country.

In total, 254 students were engaged in the Living Labs across all countries. Figure 1 illustrates the number of involved students (blue colours), teachers (orange colours) and parents (green colours) across the different workshops per age group and country. The graph shows a rather stable rate of students participating in each of the workshops of each Living Lab per country. The largest deviations can be seen in Italy for the age group of 14-19-year-olds. As the third workshop was scheduled at a time where school has already closed for the summer holidays, this workshop was held online with the presence of only the GenB partner and two teachers involved to continue the lab process [Italy, FVA, WS1-3, 14-19-year-olds]. Nevertheless, FVA organised a couple of online meetings in September and October 2023 with the presence of both students (n=25) and teachers (n=3) to fine-tune and finalise the product of the experimentation phase. The escape game developed by the participants of this Living Lab were showcased in two large scale events in October. Another deviation is visible amongst the youngest age group (4-8-year-olds) in Slovakia. As one of the class teachers decided to discontinue with the Living Lab process beyond the second workshop, only one of the original two classes in the Living Lab with 4-8-year-olds implemented the third workshop (from 42 in WS1, to 39 in WS 2 and only 24 participants in WS3) explaining the deviation in number of participants [Slovakia, PEDAL, WS1-3, 4-8-year-olds].

During all workshops, teachers were involved, whereas their number varied from 1 to a maximum of 6 involved at one workshop. As can further be seen from Figure 1, only a marginal number of parents could be directly involved in the workshops; only Slovakia directly engaged parents in the second and third workshops of 4-8-year-olds.

The role and support of the involved teachers was key for a successful Living Lab. Their presence during the workshops, their readiness to moderate group dynamics, uplift the students' motivation and supporting with technical explanations as well as the facilitation was reported crucial [Austria, ZSI, WS1, 4-8 & 9-13-year-olds; Slovakia, PEDAL, WS 1-3, 9-13 & 14-19-year-olds]. Also, often the teachers were directly involved to keep the Living Lab alive in the phases between the workshops, supporting the students with their tasks and even offering their lessons to continue working on the bioeconomy lab e.g., Austria, ZSI, WS2, 14-19-year-olds. The teachers' support was crucial in finalising the pilot ideas; one teacher became sick between workshop 2 and 3 leading to students not being able to finalise their projects, as the necessary management of time-allocation between different subjects had not taken place [Slovakia, PEDAL, WS1-3, 4-8-year-olds]. In contrast, also a teacher deciding for a class to stop participating further had far reaching consequences with a part of 4-8-year-olds dropping out from the Slovakian Living Lab after workshop 2 [Slovakia, PEDAL, WS1-3, 4-8-year-olds].

Methodology-wise the Living Lab process built on the active engagement of pupils, giving them the possibility to ask questions whenever they arise throughout the workshop settings [Austria, ZSI, WS1, 4-8 & 9-13-year-olds], and using child-centred and engaging and interactive formats [Slovakia, PEDAL, WS 1-3, 4-8-year-olds]. "The friendly and collaborative environment in the classroom facilitated effective communication and sharing of experiences among the students. This positive atmosphere encouraged active involvement and made the workshops enjoyable for the participants." [Slovakia, PEDAL, WS 1-3, 9-13-year-olds].

The workshops employed diversified methods and techniques to keep the students' engagement high. Different settings were used, from working in plenary sessions to using a station-based-learning approach for simultaneous small-group-working-experiences [Austria, ZSI, WS2, 4-8 & 9-13-year-olds]

Importantly, the Living Lab also involved processes of appreciating the students' engagement. This was done by having a certificate ceremony and farewell at the end of the Living Lab [Austria, ZSI, WS3, 4-8 & 9-13-year-olds], awarding small prices [Slovakia, PEDAL, WS 1-3, 14-19-year-olds] or facilitating a more public sharing to present the results to a larger public [Italy, APRE, WS1-3, 4-8 & 9-13-year-olds; Italy, FVA, WS1-3, 14-19; Slovakia, PEDAL, WS1-3, 14-19-year-olds].

The duration of individual workshops varied with the age of the involved students, the context of the workshop and the general school settings. Individual workshop sessions took from about 50 minutes to 4 hours, including breaks [Austria, ZSI, WS1, 4-8 & 9-13-year-old; Slovakia, PEDAL, WS 1-3, 4-8-year-olds]. The workshop series needed to be planned according to project guidelines as well as in alignment with the engaged school(s). This was reported being a challenge, as some school specific events and exam weeks partly interfered with participation

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rates. For example, the summer festival preparations happened alongside workshop 3 in Austria [Austria, ZSI, WS3, 4-8 & 9-13-year-olds] and, since school year was already over, in workshop 3 for the oldest age group (14-19-year-olds), only two teachers without students took part in Italy [Italy, FVA, WS1-3, 14-19-year-olds].Therefore for the success of the Living Lab, FVA decided to organise an additional online meetings in October to involve both students and teachers in the finalisation of the escape game, towards the final showcase and validation with parents and general public in the context of two large scale events. Also, the spacing between workshops was considered important, with too long phases in between being considered counterproductive [Slovakia, PEDAL, WS 1-3, 9-13-year-olds]. The workshop structure is described in more detail in the following section.

4.2.3.2 Workshop Structure Overview

According to the guideline for Living Labs provided by ZSI, the goal of workshop 1 was to: "familiarise the participants with the topic of bioeconomy and specifically to help them connect the dots with regards to its meaning for their everyday life in an age-appropriate manner. "In this regard, an introduction to bioeconomy, a so-called familiarisation, a reflection and often also hands-on experiences were part of workshop 1. The phase in between workshop 1 and workshop 2 could be used differently by the Living Labs, with some partners attributing the involved students with small tasks to either complete by themselves (e.g. answer to reflective questions [Austria, ZSI, WS1, 14-19-year-olds; Italy, APRE, WS1-3, 4-8 & 9-13-year-olds]) to involve their parents in (e.g. ask their parents about the questions posed [Italy, APRE, WS1-3, 4-8 & 9-13-year-olds[), or to do as a group (all Living Labs organised in Austria co-designed ideas in the period between workshop 1 and workshop 2 with the support of the involved teachers [Austria, ZSI, WS2, 4-8, 9-13 & 14-19-year-olds].

According to the guidebook for Living Labs, the goal of workshop 2 was to have concrete projects with clear intentions and target groups. Accordingly, most second workshops included a phase of co-designing ideas for pilot actions, evaluating and improving these ideas and concretising the necessary steps to implement the pilot until workshop 3. The individual implementation of this phase varied between the labs. For example, all Living Labs organised in Austria already started workshop 2 with prepared co-design ideas, which were created between workshop 1 and 2 [Austria, ZSI, WS2, 4-8, 9-13 & 14-19-year-olds].

The phase between workshops 2 and 3 foresaw a completion of the pilot ideas. Also, students got again small tasks and assignments to keep them engaged with the topic of bioeconomy [Slovakia, PEDAL, WS 1-3, 4-8-year-olds]. Further, also other stakeholder groups were engaged in the pilot development, by e.g., asking parents for feedback [Slovakia, PEDAL, WS 1-3, 4-8 & 9-13-year-olds].

According to the guidelines of the GenB Living Labs, the goal of workshop 3 was to showcase the final projects and products to a wider audience and specifically to the target of the projects and products. Additionally, this workshop was aimed for the participants of the Living Labs to reflect on whether their projects and products met their intended goals and whether there was need

to adjust any aspects. This final session also involved collecting feedback from the participants on the Living Lab process. In this regards, most Living Labs presented their pilots in this workshop session, with three exceptions: one of the two youngest groups (4-8-year-olds) involved in Slovakia deliberately stopped being involved in the process after workshop 2 and hence did not present the results [Slovakia, PEDAL, WS 1-3, 4-8-year-olds[; the two younger Italian groups (4-8 and 9-13-year-olds) presented their pilots at an additional event, following workshop 3, namely the "Sustainability Day" open school event, to get feedback from the school community, and external stakeholders [Italy, APRE, WS1-3, 4-8 &9-13-year-olds[. For organisational reasons and with the aim to engage a larger number of audience, the oldest age group (14-19-year-olds) engaged in Italy by FVA had their presentation at the Maker Faire and Fermhamente (a science festival in Fermo) in October 2023 [Italy, FVA, WS1-3, 14-19-year-olds]. Workshop 3 was also used to appreciate the work and activities that have happened throughout the Living Lab process [Austria, ZSI, WS3, 14-19-year-olds].

Workshop 3 in Austria and Slovakia and workshop 4 in Italy were the last workshops of the Living Labs. However, some activities of the lab might continue for further exploitation and development. For instance, some participants might become GenB ambassadors. The oldest age group in Austria, for example, brainstormed ideas how to individually follow the topic of bioeconomy [Austria, ZSI, WS3, 14-19-year-olds]. Also, some teachers involved, planned to continue working on the topic also throughout the next school year [Austria, ZSI, WS3, 4-8 & 9-13-year-olds]. In order to support this activity, ZSI as corresponding facilitator sent an email to the teachers with concrete examples, how they might develop their projects further. [Austria, ZSI, WS3, 4-8 & 9-13-year-olds]. APRE and FVA decided to present the results and processes of the Living Lab as good practice in conferences and events at national and European level. Furthermore, APRE invited experts to a focus group to validate the board game created by the students.

Chapter 4.2.4 of this report reports on each of the different phases of all Living Labs in more detail.

4.2.3.3 Methods and tools

For the implementation of the Living Labs, diverse methods and tools were used to create engaging and interactive learning experiences for the participants. These methodologies and tools were carefully chosen to ensure that the students understand the role of the bioeconomy. The methods were attuned to a user-cantered, student-cantered approach aiming to produce new educational formats on the bioeconomy challenges together with the students. Methodologies and tools were carefully incorporated into the Living Lab workshops to cater to the diverse learning needs of the students. The interactive and participatory approach helped in capturing the students' interest and fostering a deeper understanding of environmental issues and the potential of the bioeconomy [Italy, APRE, 4-8 and 9-13- year-olds; Slovakia, PEDAL; 4-8-year-olds]. Methods and tools were selected according to the age of participants and adapted for face-to-face or online use.

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Especially in the Slovak Living Lab of the 9-13-year-olds it was experienced that the workshop process demonstrated the importance of adjusting the methodologies to suit the students' prior knowledge and experience. By aligning with the approaches applied by the teacher in regular classes, the workshops were better tailored to students' needs, ensuring a seamless transition into the bioeconomy topic [Slovakia, PEDAL; 9-13-year-olds].

One common method used in the workshops was inquiry-based-learning, a child-centred approach [Austria, ZSI, WS2, 4-8 and 9-13-year-olds; Italy, APRE, 4-8 and 9-13-year-olds; FVA, 14-19-year-olds]. In the Austrian primary school, this method was e.g., used for explaining to the participants what their assignment was until the next workshop with the relevant instructions and context and at the same time encouraging them to ask questions regarding the assignment and what was expected of them. This promoted independent thinking, active participation and interaction [Austria, ZSI, WS2, 4-8 and 9-13-year-olds].

Other methods and tools used for the Living Labs in primary school were experiential hands-on activities, creative formats (arts and crafts), design-thinking, game-based learning, brainstorming, group work, flipped classrooms (students presenting to the class), Students2Students formats (students presenting the results and demonstrating the game to other students), toolkits produced in the Transition2Bio project (videos, cards, bioeconomy book for kids) for inspiration and materials as billboards, post-its, paper cards, colours, clay, dices or PowerPoint presentations [Italy, APRE, 4-8 and 9-13-year-olds]. Furthermore, brainstorming, interactive discussions, storytelling and practical demonstrations and group interviews were combined to ensure that the workshops were engaging and effective in achieving their objectives. The storytelling method, in particular, allowed students to express their creativity and develop their projects in a compelling way [Slovakia, PEDAL; 4-8 and 9-13-year-olds].

In the secondary schools also, interactive tools were implemented to actively engage students (e.g., Mentimeter sessions) as well as experiential activities for inspiring them and design-thinking methodology, brainstorming, game-based learning and inquire-based learning to further develop the project ideas. Online tools and templates were used to facilitate the collection of inputs for the co-design of the escape game (e.g., Miro board, templates to design quizzes and enigmas) [Italy, FVA, 14-19-year-olds; Slovakia, PEDAL, 14-19-year-olds].

For the reflection and feedback sessions with the students at the end of the single workshops the following methods were used:

- One-word-feedback to allow those students, who wanted to, to voice short feedback about the workshop session [Austria, ZSI, WS2, 14-19-year-olds].

- Brainwalk is a useful method to tease out knowledge and experiences of participants by walking silently in a room. The participants were given a marker to write their responses directly on the flipcharts with the following questions: What did you like about the workshops? What didn't you like? With whom did you speak about the Living Lab process and/or your project? How do you intend to follow the topic further? By

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collecting the responses to these open questions, the moderators were able to garner rich insights into the impact of the Living Lab process as well as feedback into how the workshops should be organised better in the future [Austria, ZSI, WS3, 14-19-year-olds].

- The method of reflective learning was implemented in a Mentimeter exercise. Here, the participants were encouraged to think critically about their initial knowledge, understanding and attitudes with regards to the topic of the bioeconomy and then to reflect on how these had changed as a result of the workshops and the Living Labs process as a whole. This was aimed at not only gathering the insights in terms of evaluation – whether the Living Lab process in this case met its set objectives, but also to help the participants become more aware of their own learning processes. The Mentimeter questions included knowledge of the bioeconomy before and after the workshops/Living Labs process as well as the change in attitude with regards to the topic. [Austria, ZSI, WS3, 14-19-year-olds].

4.2.4 Workshop content and results

4.2.4.1 Introduction

4.2.4.1.1 Introduction of workshops

Regardless of the country and Living Lab age group, at the beginning of the first workshop, the project staff started off by introducing themselves, explaining to the pupils in an age-appropriate manner the process of the Living Lab and giving them an in introduction into the topic of bioeconomy. With regards to the latter, introduction to bioeconomy, neither the pupils in Austria nor Slovakia had prior direct contact with the topic, whereas in Italy, the pupils were aware of the topic as both APRE and FVA had already previously worked with the schools in the framework of past projects on the topic. Nevertheless, the Italian partners reiterated that it was necessary to refresh the concept to the pupils as given their age, they had difficulties in differentiating between bioeconomy and sustainable practices such as recycling [Italy, APRE, WS1, 9-13]. The concept of bioeconomy was introduced or refreshed (with regards to Italy) to the pupils using different formats depending on their ages (see Chapter 4.2.4.2).

For the remaining workshops, the introduction was rather simple. In Austria, the moderators always introduced themselves at each session, especially because in the Living Lab with 14-19, it was not always the same two moderators – one was always the same, but due to illness the second had to be replaced for the second workshop. In the Living Labs with 4-8 and 9-13-year-olds, two of the moderators were present during all the three sessions, however, a colleague joined the second workshop to support with the station-based design. Furthermore, due to the fact that the third workshop was also attended by pupils and teachers who were not part of the Living Labs, ZSI staff had to introduce themselves each time. In addition to introducing themselves, the moderators in Austria always made a quick recap of what happened in the previous session(s) – this was interactive in the sense that rather than just saying what happened, the participants were asked to recall and tell their peers and what the pupils can

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expect from the current session, structure etc. The recap and review methodology worked well because not only was it short, but it was able to refresh the participants' minds on the contents of the previous workshop and also set the scene of what they could expect with the current workshop i.e., contextualisation. Additionally, if there were any open questions or requests from the participants from the previous session, this information was provided and discussed. For example, in the Living Lab with 14-19-year-olds, the pupils were curious about food waste by supermarkets and what happens to food that can no longer be sold. ZSI provided this information in the next workshop and also discussed with the participants, some of which had actually researched this in the meantime.

In Italy, the following workshops with 4-8-year-olds and 9-13-year-olds always started with refreshing the pupils' memories on the concepts of bioeconomy as it was noted that they had difficulties in differentiating bioeconomy and sustainability practices such as recycling.

4.2.4.1.2 Icebreaker activities

In all the workshops in Austria and Italy, icebreaker activities were used to create a comfortable and friendly atmosphere and engage the participants right at the beginning of the workshops.

Some of the icebreaker activities that were implemented include:

1. **Sociometric line-up** [Austria, WS1 of all Living Labs]
    a. **Living Labs with 4-8 and 9-13-year-olds**: How interested are you in the environment? In how far do you think you can do something as an individual to protect the environment? A majority of the students "completely agreed" with the two questions. Very few only "agreed", and none "disagreed" or "disagreed completely". This was a good indication that they would be interested in the topic.
    b. **Living Lab with 14-19-year-olds**: Does the topic of bioeconomy mean anything to you? Are you interested in the environment? In how far do you think you can protect the environment through your actions?

2. **Toilet paper icebreaker game**: [Austria, WS2, 14-19]: This game was played to prompt pupils to recall and share thoughts from workshop 1. Toilet paper was passed to the pupils with everyone being urged to take at least one piece of paper. Afterwards, pupils were prompted to write one impression from the first workshop or things they relate to bioeconomy in case they had missed the first workshop on each paper they had taken. The written down statements were then shared with the group in a short plenary discussion session.

3. **Sustainable practices bingo game**: To ease the participants into the session, they were asked to play a game of bingo designed by ZSI staff on the topic of sustainability and specifically individual behaviours that support this (see Appendix 7.3.1.2.3) e.g. uses a reusable bottle, buys clothes second hand, does not eat meat because of the environmental impact of meat production etc. Each participant was given a sheet of

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paper and was encouraged to go around the room and talk to their peers in order to complete the sheet i.e., enter the name of the person that practices one of the items listed. The person who completed one column the fastest and shouted “Bingo” won the game.

The reports from Slovakia indicated having used icebreaker activities in their workshops, however further information was not provided, hence all the examples above are from Austria.

Icebreakers are considered vital in such workshop settings because they:

- enabled a positive, friendly, energy-field and at the same time relaxed, dynamic, interactive and inclusive atmosphere, which continued throughout the rest of the agenda points.
- eased the pupils into the setting as on one hand it signalled to them that they were allowed to have their own opinion (by rating the different questions) and on the other hand that their opinion was respected, valid and valued (through the possibility to voluntarily explain their ratings – this created a low-pressure setting)
- broke down any inhibitions or shyness that may have been associated with dealing with the moderators who they were not familiar with.
- Promoted interaction among the pupils as e.g., in Austria, the Living Lab with 14-19-year-olds involved pupils from three different classes who otherwise have only limited interaction, with the bingo game, they were “forced” to interact with peers that they were not very familiar with.

4.2.4.1.3 Closing of workshops

The closing sessions of the workshops varied. Only information from Austria in respect to this topic could be deduced from the report, which seems also valid for Italy and Slovakia. In general, the participants were thanked for their active participation and told of what to expect of the following workshop to ensure that the students remain focused on the topic as well as what was expected from the final workshop: The pilot projects. After the second workshop in Austria with 14-19-year-olds, their feedback was also requested using one word. This was done to allow pupils, who wanted, to voice short feedback about the workshop session, this chance was taken by a majority of the participants. Furthermore, during the closing session of the Living Lab in Austria with the same age group, after the evaluation, the participants were given information about the GenB call for bioeconomy ambassadors, what it’s about and how they can apply. As the call was not yet out, this point was only mentioned and not really highlighted. The participants were promised further information at a later date. ZSI staff sent the relevant information to the teachers involved by email and requested then to share it with the participants and other students in general. Again, the participants were appreciated for their great effort and input in the process and each of the classes that were involved was presented with a certificate of participation. The certificate of participation and appreciation was also done individually for every class that took part in the Living Labs with 4-8-year-olds and 9-13-year-olds. For all Living Labs ZSI followed up the last session with an email to the teachers with

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reflection questions for the teachers about the Living Labs process, suggestions of the how the pupils could continue working on their projects (this included also suggestions from the pupils and teachers themselves at the third workshop) and information on the call for GenB ambassadors and how to register.

4.2.4.1.4 Commonalities and strengths

1. **Icebreakers**: In all three countries, icebreaker activities were undertaken pretty much at the beginning of almost each workshop after the team had introduced itself.

2. **Introduction to the Living Labs process**: In all cases, the Living Lab process was explained to the participants.

3. **Interactive Engagement**: Interactive methods, such as discussions, demonstrations, quizzes and hands-on activities, were used to engage participants and facilitate a deeper understanding of the topic.

4.2.4.1.5 Disparities and complexities

1. **Differentiation between age groups**: In Austria and Italy, the introduction to the topic as well as all the workshops in general for the age groups 4-8 and 9-13 were practically the same while in Slovakia there was more differentiation in the content and delivery of the workshops between these two age groups.

4.2.4.2 Familiarisation

The phase of familiarisation with bioeconomy was an important part of workshop 1 to introduce the students to bioeconomy and to provide for the context of the respective Living Lab. All Living Labs started with this phase to foster a common knowledge base. Correspondingly, defining what bioeconomy is, explaining the difference between natural and fossil resources and the need to use resources in a circular way was conveyed in the phase. The emphasis of this phase varied with the facilitating partners; In Slovakia PEDAL put an emphasis on embedding bioeconomy as one of the possible ways humans can take action to tackle the wider challenges of climate change in all of the Slovakian Living Labs. In Italy APRE put an effort to specifically convey the concept of bioeconomy as such, delineating it also from practices of recycling, which is a part of circular bioeconomy [Italy, APRE, WS1, 4-8-year-olds & 9-13-year-olds]. The following section describes in detail how the concept of bioeconomy was introduced in each country and for each age group.

1. **Austria**:
    a. **Living Labs with 4-8-year-olds and 9-13-year-olds**: For the 4-8 and 9-13 age groups in Austria, the main tool used to introduce this topic was the “What’s bioeconomy” book for kids produced by BIOVOICES project and distributed

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byTransition2Bio project. After going through selected chapters of the book, the pupils were given the task of thinking about things they use in their daily lives for example, or things they see around that they think could be produced from bio-based materials and then they were asked to draw these. For those who could not think of any products that should be created from bio-based materials, they were asked to think about what they think they could do to impact the environment positively and draw these.

b. **Living Lab with 14-19-year-olds**: For the 14-19 age group the topic was introduced through a tailored PowerPoint presentation that also included real-life examples e.g., possible uses of "ugly" fruit and vegetables (food was the current topic they were covering in one of their classes) as well as simple videos to introduce the topic of bioeconomy. To understand the concept even better, the pupils had the opportunity to explore the BioArtGallery on their devices. Furthermore, the pupils collaborated to produce plastic from orange peels (one of Transition2Bio recipes). Additionally, challenges and risks associated with bioeconomy were presented and discussed.

c. ZSI also brought a sample of bio-based products to all the workshops for all the age groups (4-19) so that the pupils could experience bioeconomy using their senses. The real-life products enabled students to see, touch, smell and even taste the products and thereby enhanced multi-sensorial experiences, which are known to enhance learning and comprehension.

d. Introductory videos about bioeconomy were used for younger and older age groups involved in all the different Living Labs. The video selection happened in an age-appropriate manner. For the older participating students, different videos describing and explaining bioeconomy in more detail were used, e.g., a video produced in the BioBridges Project 'A biobased day', was shown [Austria, ZSI, WS1, 14-19-year-olds]. In this manner, the concept of bioeconomy was linked to the living realities of the students, connecting to already existing knowledge and interests.

2. **Italy**:
   a. **Living Labs with 4-8-year-olds and 9-13-year-olds**: In the case of Italy, the topic was introduced in detail before the start of the Living Lab process in a preparation workshop. For the 4-8 and 9-13 age groups, the Italian colleagues presented a PowerPoint presentation on the topic of bioeconomy, presenting the main concepts of bioeconomy and sustainability, the sectors and bioeconomy careers. The slides were used to convey basic ideas, with e.g., process diagrams used to visualise complex concepts and help with comprehension. Like in Austria, the Italian colleagues also brought samples of bio-based products for the pupils to experience. They were also provided a vast array of toolkits to enhance their knowledge on the topic. At the first workshop

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itself, the colleagues from APRE who conducted the Living Labs with the two younger age groups, refreshed the pupils' minds on the concept of bioeconomy through a recap on the concepts and sectors of the bioeconomy and brainstorming with the students how these connect to their everyday lives. Through a timed group activity, the pupils were asked different questions and stick posts it's on billboards with their answers. The questions included: What biomass do you produce daily at home, in class? Who else produces biomass waste in your neighbourhood? How can we make our daily lives more sustainable (i.e., transforming waste into resources)? The answers were then discussed in the group.

b. **Living Lab with 14-19-year-olds**: For the 14-19 age group, FVA carried out a capacity building workshop for the pupils and their teachers (using inquiry-based learning and game-based learning to introduce more theoretical contents), where they were trained on circular bioeconomy. A small bioeconomy village exhibition (developed by BIOVOICES and BIOWAYS projects) which involved display of samples of bio-based materials and bio-based products was also set-up with the possibility for questions in order to not only deepen the participants' knowledge on the topic, but also to act as an inspiration for their pilot projects. Additionally, good practices from European projects were presented and educational toolkits from former bioeconomy projects such as Transition2BIO in forms of cards, games and experiments were used in the familiarisation phase [Italy, FVA, WS1, 14-19-year-olds].

3. **Slovakia**:
    a. **Living Lab with 4-8-year-olds**: For the 4-8 age group, the topic of bioeconomy was introduced more broadly with the workshop being titled: "How to improve the environment with bioeconomy? How can you be part of the green transition?" The choice of introducing the topic broadly was based on the fact that it was noted that young people in Slovakia have only partial knowledge (e.g. they know that it is important to save water, electricity, proper waste separation), but they often do not perceive a broader context (e.g. the importance of reducing consumption in general, the importance of choosing products), the topic of bioeconomy is unknown to them and they also do not perceive, for example, possible professions in this sector. The workshop began by discussing environmental challenges and the importance of taking action to protect the planet. It used relatable examples such as the greenhouse effect, emphasising the importance of familiar situations and products to explain new topics. A demonstration of the greenhouse effect using a blanket and a volunteer helped illustrate the concept. The workshop used an interactive approach to assess the students' existing knowledge and engage them in discussions about environmental issues. It involved a "path" activity where students placed examples of what harms the planet on tickets and identified topics, they considered important. The introduction to bioeconomy included

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presentations about Bioeconomy Village and the BioArtGallery, highlighting specific products and their positive impact on the environment. Students were encouraged to think about how they could contribute to environmental protection through bioeconomy principles and circular economy concepts.

b. **Living Lab with 9-13-year-olds**: For the 9-13 age group in Slovakia, the concept of the bioeconomy was explained, focusing on its role as a sustainable and circular economic model that uses renewable resources and minimises waste. The potential challenges and risks associated with the bioeconomy were discussed, encouraging critical thinking and a comprehensive understanding of the topic. Practical examples and actions that students can take to support the bioeconomy and promote sustainability were presented. Additionally, the students were presented with various ways that they could contribute to the green transition through making sustainable choices. An interactive activity or experiment was conducted to engage students and reinforce the concepts discussed during the workshop. Presentation of Bioeconomy Village and BioArtGallery was helpful in introducing new topics and starting discussions. “The display of the products made from unusual materials […] sparked curiosity and increased students’ interest in the bioeconomy.” [Slovakia, PEDAL, WS1, 9-13-year-olds].

c. **Living Lab with 14-19-year-olds**: Participants were asked to think about issues related to human behaviour that contributes to climate change, write them down on post-its and place them on a visual "road", illustrating the improvement of the situation as a journey. This exercise helped the moderators gauge the level of awareness and concerns of the participants regarding environmental issues. In the next phase, the moderators provided an interactive lecture on the concept of the bioeconomy. They showcased real-life examples from the Bioeconomy Village and BioArtGallery, demonstrating how the bioeconomy offers sustainable solutions to environmental challenges. The participants were encouraged to brainstorm and discuss various options through which the bioeconomy could contribute to a greener future. They were also asked to consider how they could personally take steps to positively impact the environment using bioeconomy principles.

This initial phase of the Living Labs also served to understand which knowledge children already had as well as which topics resonated with them to tailor the following Living Lab processes to their needs [Slovakia, PEDAL, WS1, 4-8-year-olds & 14-19-year-olds]. Methods used for assessing available knowledge involved for instance a mapping of environmental issues and brainstorming sessions, as well as group interviews to encourage sharing among students [Slovakia, PEDAL, WS1, 9-13-year-olds]. The familiarisation phase was also considered a training session, with a bioeconomy quiz to be taken afterwards to measure knowledge gains in a fun way [Italy, FVA, WS1, 14-19-year-olds].

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Importantly, students were encouraged to engage, ask questions and share their perspectives throughout the workshop [Slovakia, PEDAL, WS1, 4-8-year-olds; Austria, ZSI, WS1, 4-8 & 9-13]. This created an interactive atmosphere and the arising discussions allowed for a deeper exploration of the topics, which resonated with the students [Slovakia, PEDAL, WS1, 4-8-year-olds]. Students were also asked whether they knew specific terms, activities or items used in the explanation of bioeconomy. If they did, they could explain it to the rest of the involved pupils. Students were further engaged in paraphrasing presented contents to repeat the content for themselves and their groupmates. [Austria, ZSI, WS1, 4-8 & 9-13-year-olds].

4.2.4.2.1 Commonalities and strengths

1. **Introduction of the bioeconomy**: In the first workshops of all age groups in all three countries except for the Living Labs with 4-8 and 9-13 in Italy, the concept of bioeconomy was introduced to the pupils. In the exception, the introduction took part prior the start of the Living Labs process and at the first workshop, key aspects were refreshed.

2. **Emphasis on critical thinking**: The introduction into the topic in Austria (14-19), Slovakia (9-13) and Italy (14-19) included discussions of challenges and risks associated with bioeconomy. In Italy for example the connection between bioeconomy and pressing challenges (SDGs, climate change, biodiversity loss, energy and food consumption, etc.) were discussed.

3. **Educational tools:** Establishing a real-life connection with bioeconomy by linking core dimensions with the children's living experiences proved to be a core strength for the phase of familiarisation. In all cases, educational tools and materials were used to convey the concept of bioeconomy effectively. These included the book for kids, experiments, BioArtGallery, drawing, Bioeconomy village, PowerPoint presentations, toolkits and other interactive activities. For instance, the practical questions included in the book for kids, such as "how many diapers does a baby use in two years" resonated particularly well with children who had younger siblings and also led to discussions among the group [Austria, ZSI, WS1, 4-8 & 9-13-year-olds]. Also, the elephant-poo-based notebook created an immense range of emotions, from disgust to curiosity, and thereby linked the topic of bioeconomy with an emotion [Austria, ZSI, WS1, 4-8 & 9-13-year-olds]. Across all Living Labs, many students expressed support and interest in the topics, resulting in their active participation, asking questions and their eagerness to contribute to the discussions [Austria, ZSI, WS1, 14-19-year-olds; Slovakia, PEDAL, WS1, 4-8-year-olds].

4. **The diverse methodology**: employed enabled the pupils to catch and keep an interest in the topic. The presentation of different perspectives of bioeconomy, which in itself encompasses different elements such as sustainability, ecology, biology etc., enabled a broader understanding of the topic [Austria, ZSI, WS1, 4-8 & 9-13-year-olds, Italy, all WS]. The incorporation of different practical activities in the phase of familiarisation enabled

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children to apply the knowledge they had gained and enabled them to consider this for application in real-life contexts. Thereby, they deepened their understanding. [Austria, ZSI, WS1, 4-8 & 9-13-year-olds; Slovakia, PEDAL, WS1, 4-8 & 9-13-year-olds].

4.2.4.2.2 Disparities and complexities

2. **Complexity of the concept**: Bioeconomy is a complex concept. As a consequence, it is challenging to explain it fact-based in an age-appropriate manner [Austria, ZSI, WS1, 4-8 & 9-13-year-olds; Italy, APRE, WS1, 4-8-year-olds]. In Austria for example, it was observed that the younger age groups involved had to difficulties in even pronouncing the German term 'Bioökonomie' [Austria, ZSI, WS1, 4-8 & 9-13-year-olds]. Slovakia introduced the topic of bioeconomy broadly to the 4-8 age group, emphasising the importance of environmental protection and offering relatable examples. Furthermore, Slovakia included discussions about human behaviour contributing to climate change and how the bioeconomy could be a part of the solution [Slovakia, PEDAL, WS1, 4-8-year-olds]. However, depending on national school curricula, also older students might not have a basic understanding of environmental issues. In Slovakia, the Living Lab for 14-19-year-olds therefore also needed to create a basic understanding before delving into the specifics of bioeconomy [Slovakia, PEDAL, WS1, 14-19-year-olds]. Also, it was described challenging to share the right amount of information to make the concept comprehensible, yet not to overburden the young audience. It was therefore suggested to focus on specific contexts close to the children's living realities, rather than going through many different contexts [Austria, ZSI, WS1, 4-8 & 9-13-year-olds].

3. **Differentiation between age groups**: In Austria and Italy, the introduction to the topic as well as all the workshops in general for the age groups 4-8 and 9-13 were practically the same while in Slovakia there was more differentiation in the content and delivery of the workshops between these two age groups.

4. **Content delivery**: Austria used the children's book: "What's bioeconomy?" to introduce the concept of bioeconomy to the younger age groups, while Italy employed PowerPoint presentations and toolkits to introduce the concept to all age groups. Nevertheless, in Italy and Slovakia the book was used to inspire the participants.

5. **Preparation workshop**: Italy introduced the topic in detail through a preparation workshop for the age groups: 4-8 and 9-13.

6. **Prior knowledge of the bioeconomy**: Participants in Italy had been involved in previous projects on the topic while for those in Austria and Slovakia this was the first real contact to the topic.

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7. **Addressing attention span challenges**: Apart from topic-related challenges in the familiarisation phase, some Living Lab facilitators also ran into challenges regarding keeping the attention span of the young audience, as the handed-out materials were quite intriguing. For the future, especially younger children should get the possibility to explore the materials in their own time, to hinder from distractions during plenary sessions [Austria, ZSI, WS1, 4-8 & 9-13-year-olds].

8. **Infrastructure**: Also, problems related to the infrastructures available in rooms, such as a poor internet connection, hindering from showing an online version of the bio-economy picture book or a the interactive BioArtGallery online version created some challenges in the phase of familiarisation [Austria, ZSI, WS1, 4-8 & 9-13 & 14-19-year-olds].

4.2.4.3 Reflection

While the familiarisation phase was used to provide a first understanding of bioeconomy and linked issues and dimensions, the phase of reflection was used to enable students to see how they and their lives are connected with bioeconomy. As such, reflection was also an important phase of the first workshop in all Living Labs.

In order to support the students in an age-appropriate manner to transfer the concept of bioeconomy to their daily lives, the facilitators asked them reflective questions, such as:

- "Think about things you use in your daily lives? What can be produced from bio-based materials?" [Austria, ZSI, WS1, 4-8 & 9-13-year-olds]
- "How to help the planet?" [Slovakia, PEDAL, WS1, 9-13]; "What can you do to impact the environment positively?" [Austria, ZSI, WS1, 4-8 & 9-13-year-olds]; "How can we make our daily life more sustainable?" [Italy, APRE, WS1, 4-8-year-olds]
- "What biomass do you produce daily at home? What biomass do you produce in class?" [Italy, APRE, WS1, 4-8-year-olds]
- "Who else produces biomass waste in your neighbourhood?" [Italy, APRE, WS1, 4-8-year-olds]

These questions were discussed in group work or/and in plenary together with the moderators and first ideas were generated and collected. Other questions were discussed in the format of group interviews, to encourage sharing among the students [Slovakia, PEDAL, WS1, 4-8-year-olds]. First answers were collected using post-its and billboards, to provide the basis for further group discussions [Italy, APRE, WS1, 9-13-year-olds].

Some students were also presented with various ways they can contribute to the green transition and to make more sustainable choices in their daily lives [Slovakia, PEDAL, WS1, 9-13-year-olds]. This was exemplified by an exercise involving a path – students were encouraged to place issues related to human behaviour contributing to climate change on the visually displayed road, thereby also visualising the impact of their actions [Slovakia, PEDAL, WS1, 14-19-year-

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olds]. This exercise was then picked up again to visualise "how, with the help of bioeconomy they can take steps that will have the opposite effect." [Slovakia, PEDAL, WS1, 9-13-year-olds]. Other materials, such as games, cards and books relating to the topic were used to inspire reflection processes and fuel a first brainstorming exercise. [Italy, APRE, WS1, 4-8-year-olds].

Another strategy pursued was to link the topic of bioeconomy with one of the topics taught already in class. In vain of this, the ZSI team picked up the topic of food and food waste, taught previously in "human and environment lessons", the course the Living Lab was happening in, to discuss about the food industry as one application areas of bioeconomy and how bioeconomy could contribute to reduce food waste [Austria, ZSI, WS1, 14-19].

In order to steer even further reflection processes, and to involve the parents and caretakers of the students in the activity, the APRE team asked students to engage in a small homework task in the period between workshop 1 and 2: Students were asked to take pictures and videos about biomass in their homes and neighbourhoods, as well as actions to reuse the 'waste' at home and in the neighbourhood [Italy, APRE, WS1, 4-8].

4.2.4.3.1 Commonalities and strengths

Also in this phase, the use of interactive methodology proved key to "encourage active participation and engagement among the students. This approach allowed them to freely share their thoughts, ask questions and express their ideas." [Slovakia, PEDAL, WS1, 4-8-year-olds]. The reflection phase could, however, also build on the ground provided in the earlier phase of familiarisation – the used materials and methods inspired the young audience to rethink their habits and also "more complex issues, such as production and consumption patterns and habits" [Slovakia, PEDAL, WS1, 14-19-year-olds].

4.2.4.3.2 Disparities and complexities

Neither disparities were evidenced in the analysis nor complexities were reported for this phase of the Living Labs.

4.2.4.4 Hands-on-activities

In order to engage the students even more deeply in bioeconomy, some workshops involved hands-on activities and experiments. For the oldest age group of 14-19-year-olds in Austria, ZSI facilitated the creation of bioplastics based on orange peels, a recipe from the Transition2Bio project [Austria, ZSI, WS1, 14-19-year-olds]. The youngest age group involved in the Slovakian Living Lab created seed balls to show a concrete example how bioeconomy can change the quality of life in the city through the creation of green spaces or the possibility of own food production [Slovakia, PEDAL, WS1, 4-8-year-olds]. In a station-based workshop, ZSI engaged the two younger age-groups equally in creating seed balls, but also in paining with plant-based, vegetable-based and spice-based colours [Austria, ZSI, WS2, 4-8 & 9-13-year-olds].

Within all these hands-on activities, it was important to explain the process behind the activity, to establish a clear link between the action and the concept of bioeconomy. Painting and colours are close to young children's living realities. Replacing artificial colours with self-produced colours, which could even be tasted, was therefore a practical way to directly interlink the use of otherwise possibly wasted biomass with direct activities [Austria, ZSI, WS2, 4-8 & 9-13-year-olds]. For painting with plant-based colours, vegetable wastes were used to create natural colourings, which could be used as water colours. These colours were pre-prepared outside of the workshop setting, on the basis of time constrains and safety-concerns (a stove for boiling the water with the ingredients would have been needed), but the process was visualised in a stepwise approach. Furthermore, the colours based on adding water to spices were mixed as needed on the spot in the workshop session [Austria, ZSI, WS2, 4-8 & 9-13-year-olds].

The seed-ball creation was embedded in the context of urban spaces and the need for biodiversity, as well as basic biology ("what do seeds need to grow?") [Austria, ZSI, WS2, 4-8 & 9-13-year-olds; Slovakia, PEDAL, WS1, 4-8-year-olds]. By producing seed balls, which could then be placed outside, children could take something with them from the Living Lab and see the effects in real-life contexts.

The hands-on experiments used techniques of inquiry-based learning – for example, when painting with plant-based colours children could guess the plant, the colour was based on [Austria, ZSI, WS2, 4-8 & 9-13-year-olds]. The hands-on exploration engaging several senses at once when directly engaging with materials and experiential learning were core methodologies employed – for example when creating the seed balls, the shares of the different ingredients are detrimental for the consistence and cohesion of the final ball [Austria, ZSI, WS2, 4-8 & 9-13-year-olds; Slovakia, PEDAL, WS1, 4-8-year-olds].

Visual aids and demonstrations were used throughout this phase, ranging from pictures of the ingredients used for the plant-based colours created by ZSI to a blanket used by PEDAL to make children experience the greenhouse effect [Austria, ZSI, WS2, 4-8 & 9-13-year-olds; PEDAL, Slovakia, WS1, 4-8-year-olds].

Beyond these activities, all workshops happening in face-to-face-settings with the students participating in the Living Labs included hands-on activities such as quizzes or games relating to bioeconomy and employed playful learning methodologies. One example thereof is a bioeconomy memory game created in the Transition2Bio project, which additionally included information on the bio-based products possibly created from biomass [Austria, ZSI, WS2, 4-8 & 9-13-year-olds].

4.2.4.4.1 Commonalities and strengths

The hands-on experiments turned bioeconomy tangible and graspable and enhanced several skills of the involved young audience. This was for example the case when spices were mixed

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with water for creating paints and participants could see whether spices were soluble in water, whether stirring was needed and how different amounts of liquid influence the process [Austria, ZSI, WS2, 4-8 & 9-13-year-olds]. Similarly, the creation of seed balls also required that the required properties for balls forming were met and hence the shares of wet and dry ingredients matched [Austria, ZSI, WS2, 4-8 & 9-13-year-olds]. Most of the participants were excited by the offered activities and engaged eagerly.

Also, the games resonated well with the involved audience, with e.g., the bioeconomy memory steering discussions and an exchange of knowledge amongst the involved students, reinforcing their understanding of the connection between raw materials and final products [Austria, ZSI, WS2, 4-8 & 9-13-year-olds].

The station-based approach chosen by the ZSI team to facilitate the hands-on experiments with the two younger age groups (4-8 & 9-13-year-olds) led to 15 iterations of the experiments, which also implied that the processes improved over time and experiments run more and more smoothly [Austria, ZSI, WS2, 4-8 & 9-13-year-olds]. The station-based approach also ensured that children could experience different approaches to bioeconomy, thereby increasing the probability that at least one of the approaches resonates with every young learner involved.

The facilitation of hands-on experiments required a special preparation of the rooms used, with e.g., desks covered with recycled plastics, to prevent stains and ease cleaning processes after the experiments and having a hand brush available for cleaning. Also, having a tap in the same room was reported being very useful for both, the seed balls as well as the plant-based colours, as the involved children needed to wash hands and facilitators needed to wash materials after use [Austria, ZSI, WS2, 4-8 & 9-13-year-olds].

Also, the involvement of the teachers helped with managing group dynamics as well as supporting students in the experiments [Austria, ZSI, WS2, 4-8 & 9-13-year-olds; Austria, ZSI, WS1, 14-19-year-olds].

4.2.4.4.2 Disparities and complexities

Timing experiments properly was reported as a challenge, as they need to involve explanation but also allow for student-led exploration [Austria, ZSI, WS2, 4-8 & 9-13-year-olds]. The station-based approach chosen by ZSI, which involved the Living Lab of 4-8-year-olds as well as the one of 9 to 13-year-olds in the second workshop, required the moderators to repeat one experiment lasting for about 10 minutes 15 times with different small groups. This was challenging and tiring from a facilitation perspective, as the strict timing hindered from completely adapting the experiment to the group's needs. For example, the methodology of creating seed balls seemed to be more appropriate with the younger age group involved, as the process was guided, and responsibilities were shared sequentially in the group. Whilst this worked out well with the younger age groups, some of the older students engaged voiced boredom – they might have been able to interpret the recipe themselves rather than having guidance. This would have

possibly required more time than the available 10-minute slots [Austria, ZSI, WS2, 4-8 & 9-13-year-olds]. Depending on the set-up and the possibilities to re-arrange tables in rooms, it was further not always easy to involve all students in hands-on activities [Austria, ZSI, WS1, 14-19-year-olds].

The hands-on experiments directly engaged the students and hence, the results of these experiments were dependent on the process. This led to challenging situations, with e.g., seed balls crumbling [Austria, ZSI, WS2, 4-8 & 9-13-year-olds], which also implied moderating frustrating processes. In the end, however, most of the results turned out to be satisfactory.

The instructions for some hands-on experiments turned out to not be completely clear. Without having tried them prior to the workshop, the facilitation of the experiments turned out to be challenging. This was, e.g., the case with creating bioplastics. The involvement of the teacher and the students, however, led to a successful production of orange-peel-based bioplastics [Austria, ZSI, WS1, 14-19-year-olds].

4.2.4.5 Co-Design of Ideas

4.2.4.5.1 Austria

4.2.4.5.1.1 Living Labs with 4-8-year-olds and 9-13-year-olds

In Austria with the Living Labs with 4-8-year-olds and 9-13-year-olds some time was dedicated towards the end of the first workshop to kick-start the co-creation phase of the Living Labs. The moderators instructed the participants to think together with their teachers and if possible, with their parents, how they could help the environment using the bioeconomy and think about how they could show or explain this to other children. Then together in groups or as a class, they should develop something that can be for example a bio-based product, a game, a video, an experiment, a cookbook etc. After the workshop, ZSI compiled different formats to stimulate their ideas or inspire them (see Appendix 7.4). This compilation includes examples from other projects but also the results of the GenB common ground workshop. In the drawing exercise the participants were already able to individually or in small teams start thinking about their projects/products. The teachers were instructed and encouraged to undertake the co-creation exercises with their pupils until the next workshop.

At the second workshop of the Living Labs with 4-8-year-olds and 9-13-year-olds in Austria, one of the stations involved presenting and discussing the project ideas of the participants. Each class together with their class teachers had reflected on the learnings from the previous workshop and had already brainstormed ideas. All the classes except one, had very clear ideas of the projects that they wanted to explore further and there was no need to vote on the projects or narrow the ideas down, i.e., first part of the exploration stage, as this had already taken place in the period between the two workshops.

The one class that was an exception, had gone through the co-creation stage in the period between the workshops, however, the participants still needed further discussion of the ideas

and selection of those that were feasible. As a result, during project ideas station, this group went through the first part of exploration stage – generation of further ideas. Due to time restraints, they agreed to continue with this stage after the workshop and after selecting the ideas they wanted to pursue, they would then work on bringing the chosen idea or ideas to life.

Some of the ideas that came from the project ideas discussions with the Living Labs with 4-8-year-olds and 9-13-year-olds in Austria included:

- **Living Lab 1 with 4-8-year-olds**
  - Make something out of pages of old books that are no longer being used
  - Handicrafts from tetra pack, eggshells and other waste
  - Continue with the topic of bioeconomy into the next school year
  - Carpet from tree (paper and floor from tree/wood)
  - Paint colours for Easter eggs:
  - Red paint colour from tomatoes, beetroot
    - Yellow paint colour from the dandelion flower, turmeric
    - Orange colour from carrots
    - Green colour from leaves, matcha tea
  - Electricity from animal waste
  - Snacks box from maize
  - Shoes from pineapple peels
  - Wheels from roots of flowers
  - Sunscreen from fish
  - Containers from empty bottles
  - Toy houses e.g., the big ben from boxes e.g., amazon packaging
  - Coffee grounds for gardening
  - Composting and reusing the soil
  - Compost old floorboards or use them to make tables
  - Dry and plant seeds from pumpkin, tomatoes
  - Pencil holder from toilet paper rolls
  - Manikins and jewellery from chestnuts
  - Watering can from plastic bottles
  - Key holder from a camping wristband
  - Fuel from cherry stones
  - Cherry pit cushion

- **Living Lab 2 with 4-8-year-olds** (this was the Living Lab that needed more time for co-creation during this workshop)
  - Song following the melody of “old McDonalds” or “Shalala”
  - Story
  - Poem
  - Video series
  - Poster with photos
  - Flyer for a play

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- **Living Lab with 9-13-year-olds**
  - Flower bed
  - Newspaper/newsletter/magazine to inform parents and families about the bioeconomy
  - Video on the topic of bioeconomy

The Living Labs with 9-13-year-olds had already completed the exploration stage during the period between the first two workshops and hence the ideas listed above had already been finalised. At the project idea station, these were only mentioned and the detailed planned for execution, not as this was already set.

4.2.4.5.1.2 Living Lab with 14-19-year-olds

Just like with the Living Labs with the younger age groups in Austria, the pupils of the Living Lab with 14-19-year-olds were instructed at a dedicated session during the end of the first workshop, to think together with their teachers and if possible, with their parents and peers, what ideas focusing on bioeconomy and raising the awareness on bioeconomy come to their mind. Then together in groups or as a class, they should develop something that can be for example a bio-based product, a game, a video, an experiment, a cookbook etc. After the workshop, ZSI compiled different formats to stimulate their ideas or inspire them (see Appendix 7.5). This compilation includes examples from other projects but also the results of the GenB common ground workshop.

The co-creation phase took place in the period between the first and second workshop, due to the fact that the participants decided on the projects to develop, it was decided that this would be the focus of the second workshop rather than following up on what happened in the period in between i.e. how many ideas were generated, which ideas were they and how was the decision on the final project ideas made. As a result, there is no record of all the ideas that were generated by this Living Lab.

4.2.4.5.2 Italy

4.2.4.5.2.1 Living Labs with 4-8-year-olds and 9-13-year-olds

In Italy, the co-creation phase of the Living Labs process for 4-8 and 9-13-year-olds took part to a great extent during the first workshop. Together the Living Labs participants and moderators brainstormed on some first ideas of the educational materials to produce to educate on the bioeconomy. The moderators asked pupils to collectively or individually think about a type of educational instrument/material they would like to produce to teach other students about the bioeconomy. Each pupil in the case of the Living Lab with 4-8-year-olds and groups, in the case of the Living Labs with 9-13-year-olds then presented their collected ideas on a poster. These posters were then presented to the groups and discussed. Additionally, the workshop facilitators showed the participants material from other projects e.g., memory game, environmental games, bioeconomy book for kids to inspire their idea generation.

The ideas from the Living Lab with 4-8-year-olds, which were brainstormed and presented on an individual basis included: Board games, car games, riddles, gaming platform, teaching sheets and memory game. Whereas the ideas generated by the Living Lab with 9-13year-olds-included:

1. Two ideas were related to the creation of a board game similar to monopoly on the bioeconomy involving cards, riddles and questions (possible names: “saving nature” and “bioeconomy monopoly”).
2. An education factsheet/exercises connecting biomasses with bio-based products
3. A mechanism to be physically produced to create new bio-based products

The co-creation phase was closed during this workshop with the decision of the project to be further pursued being taken, i.e., the board game, marking the beginning of the exploration phase which, among others, involves coming to a consensus on the ideas to produce and experiment on from the portfolio of ideas that had been suggested.

4.2.4.5.2.2 Living Lab with 14-19-year-olds

For the Living Lab with 14-19-year-olds in Italy, like with those with the younger age groups, an important portion of the first workshop involved the co-creation phase where the participants, together with the moderators, brainstormed ideas for the design of new formats to communicate the opportunities offered by the green chemistry, the circular economy and the bioeconomy, in connection with the spectacularisation of science. The ideas that were generated in this session include:

1. Podcast with contents related to sustainability and bioeconomy, in order to raise awareness in this topic and inform the audience.
2. Escape game focused on bioeconomy, with quizzes and enigmas to solve, in order to advance in the different levels and be successful in the game.
3. Live show, with the spectacularisation of key concepts of the bioeconomy, through a piece of theatre. Chemical experiments and live demonstrations are used to open the debate and raise awareness on the sustainability and bioeconomy issues.
4. Bioeconomy bingo. Each number corresponds to an experiment to be delivered by the students to families and middle school students visiting their school.

After collection of the portfolio of the first ideas, the groups of pupils and teachers involved in the Living Lab, together with FVA team, agreed the escape game was the most suitable format to be designed as the final project. The fact that a decision was made with regards to the product to be prototyped exemplifies like with the Living Labs with the younger age groups in Italy that the co-creation phase already ended in this first workshop and the first stages of the exploration phase were also implemented here, i.e., the decision.

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4.2.4.5.3 Slovakia

4.2.4.5.3.1 Living Lab with 4-8-year-olds

In Slovakia, like in Austria the co-creation phase started during the first workshop. However, the exercise carried out to encourage pupils to think about what harms the environment and what measures they could take to help the environment was not necessarily aimed at creating a portfolio of project ideas but rather increasing the participants' knowledge on the topic. As a follow-up to this exercise, the pupils developed ideas on steps that one could take to combat the harms to the environment using bioeconomy. Although the latter part of the exercise did not require the participants to come up with ideas for their own projects, it still enabled idea generation which is vital in the co-creation phase. Due to previous knowledge, ideas using the principles of circular economy, to a lesser extent bioeconomy, often appeared. Pupils proposed ideas of actions that can be taken at individual level using post its. The contents of the post-its were discussed together and then placed on a poster of the globe, in order to emphasise that our actions affect the situation across the planet.

This ideation was continued during the time until the second workshop, where like in Austria and Italy, the participants were given the assignment to pay attention to their surrounding with regards to behaviours they see that impact the environment. They were encouraged to ask their parents for their perspectives on this as well. The teachers were provided "What's bioeconomy?" book for kids to go through with the pupils in the meantime to help them understand the topic better and also possibly inspire their project ideas.

The second workshop for the Living Lab with 4-8-year-olds in Slovakia, marked the continuation and end of co-creation phase as well as the start of the exploration phase, by focusing on identifying and deciding on the topics that the pupils will work on.

4.2.4.5.3.2 Living Lab with 9-13-year-olds

The co-creation phase of the Living Lab process with 9-13-year-olds in Slovakia took place during the second workshop because the first workshop solely focused on presenting the concept of bioeconomy to the participants and enhancing their understanding through different activities and methodologies.

During this workshop, pupils were divided into groups to discuss their interests and ideas for projects by being encouraged to explore various possibilities for creating positive changes in their communities through sustainable practices and circular economy approaches. The goal was to foster creativity and ownership in the project development process. The facilitators supported the participants during the entire session by answering questions and providing clarifications where needed. The students were also encouraged to consult their ideas and/or how to further develop them. They were given the freedom to choose the topic that appealed most to them and decide on the format they preferred. They came up with the ideas of developing comic books and posters. As both ideas were complementary and no other ideas had

been developed, it was decided to continue with both ideas. Hence the co-design phase of the Living Labs process was concluded in this workshop and the decision on which ideas to follow, which is part of the exploration phase, took place in this workshop.

4.2.4.5.3.3 Living Lab with 14-19-year-olds

In the Living Lab with 14-19-year-olds in Slovakia, the co-creation phase of the Living Labs process started in the first workshop. The participants were requested to brainstorm and discuss various options through which the bioeconomy could contribute to a greener future. They were also asked to consider how they could personally take steps to positively impact the environment using bioeconomy principles. Potential topics were presented and discussed at the first workshop. However, these were not explicitly detailed in the reporting template. The participants together with their teacher were given the task of deciding on what project they would like to work on, whether they would like to work together as a group or in smaller groups until the next workshop. As a result, the co-creation phase was started and completed within this workshop. The first part of the exploration phase was to take place in the time until the second workshop.

4.2.4.5.4 Commonalities and strengths

1. **Co-Creation phase initiation**: In all three countries (Austria, Italy, Slovakia) and for all three age groups (except Slovakia, 9-13-year-olds), the co-creation phase of the Living Labs process started during the first workshop, where participants were encouraged to generate ideas related to bioeconomy.

2. **Idea generation**: In all cases, participants were asked to brainstorm ideas collectively or individually on how to promote bioeconomy concepts and contribute to environmental sustainability.

3. **Use of workshop moderators**: Workshop moderators played a significant role in facilitating the co-creation phase in all countries, guiding participants and providing instructions.

4. **Interactivity and group work**: Participants were encouraged to work together in groups or as a class to develop their ideas. Group discussions and presentations were common methods used to refine and select project ideas.

5. **Integration of external inspiration**: Participants were exposed to materials from other projects or examples (e.g., games, books, videos) to inspire their own ideas in all countries.

6. **Task assignments for the period between workshop 1 and 2**: In all three countries participants of all Living Labs were given specific tasks to work on between workshops,

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such as tasks related to increasing knowledge on the bioeconomy, consolidating project ideas and involving parents.

7. **Involvement of teachers and parents**: Participants in all countries were encouraged to collaborate with their teachers and, if possible, with their parents or peers to develop ideas during the co-creation phase.

4.2.4.5.5 Disparities and complexities

1. **Timing of the co-creation phase**: In Austria, the co-creation phase for all age groups began at the end of the first workshop and continued between workshops, by the second workshop all Living Labs except one had already started with the first part of the exploration stage as they had already clear ideas of the projects they would develop. In Italy, the co-creation phase started in the first workshop and continued with a series of co-design activities to fine-tune the initial idea co-created in workshop 1. In Slovakia, the timing varied by age group. For the 4-8-year-olds, this process started and in the first workshop, continued during the period in between and was concluded within the second workshop. For the Living Labs with 9-13-year-olds, the co-creation phase started only in the second workshop where it was also concluded. With the 14-19-year-olds Living Lab, the co-creation phase started in the first workshop and the participants were requested to complete it in the period in between the workshop by reaching a consensus on the project(s) they would like to follow up.

2. **Portfolio of project ideas**: In Austria there was a greater portfolio of ideas generated at the co-creation phase compared to in the Living Labs in Italy and Slovakia. In Italy in particular it was decided to focus on the most innovative and relevant formats, rather than exploring a wider number of ideas. In Slovakia, it was important to focus on raising and increasing awareness and consolidate new knowledge prior to developing the project ideas.

3. **Topics of project ideas**: The project ideas developed in the Living Labs with 4-8-year-olds and 9-13-year-olds in Austria and Slovakia were broader and involved not only bioeconomy but also circular bioeconomy, sustainability practices climate change etc. while those in Living Labs with all age groups in Italy focussed strictly on the bioeconomy Living Lab. Nevertheless, in the project developed in Italy with 14-19-year-old students, the connection between the bioeconomy and other topics like circularity, SDGs, plastic pollution as well as green chemistry have been developed as part of the concept. This likely stems back to the fact that the participants in Italy had a better understanding of bioeconomy than those in Austria and Slovakia due to their participation in previous projects.

4. **Role of workshop moderators in the co-creation phase**: In Austria, the workshop moderators primarily served as facilitators, encouraging discussions and ideas from the

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participants. In Italy It appears that the workshop moderators actively stimulated the idea generation and definition alongside the participants. In Slovakia for the age groups 9-13 and 14-19, the moderators played a similar role to the Austrian counterparts, however for the youngest age group, 4-8, they played a more active role in shaping the outcome as the children were quite young and there was limited time.

4.2.4.6 Exploration phase: Idea evaluation & selection

4.2.4.6.1 Austria

4.2.4.6.1.1 Living Labs with 4-8-year-olds and 9-13-year-olds

The exploration phase in the Living Labs with 4-8-year-olds and 9-13-year-olds in Austria was planned for the second workshop within the station "project ideas. The participants of the Living Lab with 9-13-year-olds had already started with this phase during the time between the workshops and had decided to create a series of educational videos on the topic of bioeconomy and sustainability as well as magazine on the topic. They had also assigned tasks within themselves, and everyone was clear on their roles and responsibilities. At this workshop the participants briefly explained to the moderators the projects they were working on. This group only had the task of bringing their ideas to life until the third and final workshops.

The 4-8-year-olds continued with the co-creation phase in the period between the workshops and at the second workshop presented the ideas they had and continued with the discussions. This workshop was held per class rather than per Living Lab as in the previous workshop. For classes that had already completed the co-creation of the Living Lab process, this involved participants sharing their thoughts, suggestions and perspectives related to the ideas generated previously in the co-creation process. In most cases, except for one class of the first graders, the participants themselves presented the ideas. With the former, the pupils seemed shy or/and the teacher was excited to share the ideas. Nonetheless, in this case too some of the participants spoke up to clarify the ideas. An open dialogue followed where questions were asked and some suggestions in building the ideas were shared. Due to the limited time, it was not possible to select the ideas that they would pursue further or create an action plan of who does what in this session and this activity was left to the period after the workshop. Additionally, after defining these aspects, the participants were required to use the time until the final workshop to bring their ideas to life.

At the final workshop, the participants of all Living Labs were requested to rate the activities of the second workshop, one of which was directly related to the exploration stage, namely the "discussion of project idea station".

- Living Lab 1 with 4-8-year-olds: 48.5% of the participants of first Living Lab with 4-8-year-olds indicated to "liking" this station. 30.5% of them were "neutral", while 17.8% of them indicated that they "did not like it". One of the participants did not rate this item.
- Living Lab 2 with 4-8-year-olds: 90.5% of the participants in this Living Lab "liked" this station – this represents all the participants except two who did not rate this item. This is a particularly interesting result as this was the one group that seemed least prepared

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in terms of the ideas they had brainstormed prior to the session and a lot of time here was used to brainstorm ideas.

- Living Lab with 9-13-year-olds: 33,8% of the participants of this Living Lab indicated having "liked" this station. As this Living Lab, similar to the first Living Lab with 4-8-year-olds encompassed two different classes, the rating of the two classes, who also attended the sessions separately rather differed. 47,6% of the third graders indicated "liking" this station while for the fourth graders, this was only 20%. In total, 54.3% of the participants of this living were indifferent/neutral with regards to liking this station or not (28.6% of the third graders and 80% of the fourth graders). 23.8% of the participants of this Living Lab, all third graders, did not like this station. In retrospect, the results of the fourth graders are possibly to do with the fact that their ideas were more or less finalised, most of the videos had already been filmed by this time, and therefore there was little to discuss.
- In total, 51% of all participants of all three Living Labs "liked" this station, 33.9% were neutral, 11.9% (n=5) "did not like it" and 3.2% (n=3) did not rate it.

4.2.4.6.1.2 Living Lab with 14-19-year-olds

At the second workshop of the Living Lab with 14-19-year-olds, the exploration phase of the Living Labs process continued. In the previous workshop the co-creation phase had just started, however, due to time limitations, it only involved instructing the participants on how this phase should be implemented, meaning that the co-creation phase took part in the period between the two workshops. Additionally, the first part of the exploration phase had also taken part during this period as the participants came with their decided ideas to explore further to the second workshop. As a result, this workshop aimed to support the participants on the second part of the exploration phase, namely "bringing their ideas to life" by the third workshop which was also the final workshop in the process.

Three groups had formed 1, each with a specific pilot idea in mind. The ideas were shortly presented verbally in the format of an elevator pitch by one person per group. After the presentation of each idea, the audience had the chance to ask questions and offer their feedback after which the groups went back to the drawing board armed with flipcharts and pens to elaborate the ideas further focussing on goals, target groups and aspects of the bioeconomy considered. The results were presented by one or two members of the pilot group in front of their hang flipchart and there was the possibility for listeners to ask questions or to provide feedback. The feedback and discussion were taken back to the individual groups where the ideas were concretised, and next steps defined. After a round of fine-tuning the projects based on the feedback, the concretised pilot actions were documented on the flipcharts and presented by one or two members of the pilot group in plenum. All presentations of the pilot ideas i.e., before and after fine-tuning took the format of an elevator pitch. This format strives to prompt a short description of the plans ahead, as if you described the idea to a person in an elevator, knowing that they could arrive at their floor any second. It should involve facts, a short description of the problem, the proposed solution and reasons for the solution being advantageous. This process was supported by the workshop moderators and teachers present. The closing session was used

to re-communicate the date for the third workshop as well as to define the milestone of having the pilot action ready until then.

The project ideas that were "prototyped" or "brought to life" at the experimentation phase in the next workshop included:

1. **Teaching bioeconomy in an elementary school**: The goal of this pilot is to explain the concept of bioeconomy in an elementary school to diffuse the idea further. The group plans to raise interest in the topic, do experiments (dying and colouring with bio-based colours and producing bioplastics), and share tips on how individual behaviour can positively contribute to protecting the environment. The target group of this pilot action are 9-to-11-year-old students enrolled in a Viennese elementary school. A specific school has been selected on the basis of existing connections stemming from the participants of the Living Lab. The aspects of bioeconomy this group focussed on, encompass environmental protection, recycling and the use of renewable resources.

2. **Advocate for sustainable packaging (+ develop bioplastics made from organic materials)**: The goal of this pilot is to investigate possibilities for sustainable packaging, with one side-project of particularly researching bioplastics made from organic materials. The group further plans to contact companies using unsustainable packaging to advocate for bio-based alternatives and their ideas. The target group of this pilot action is open, as sustainable packaging should become mainstream. The aspects of bioeconomy this group focusses on, encompass sustainable packaging, natural and renewable resources as well as biomass.

3. **Create an awareness raising video about bioeconomy for the school**: The goal of this pilot is to create an awareness raising video about bioeconomy which is to be screened in the students' school. The video will feature the different students of the group, who will talk about different aspects of bioeconomy, they feel most connected with upcycling of clothes, sustainable beverages, prevention of micro-plastics, packaging, the influence of media on material use, cosmetics, economic consequences of bioeconomy, environmental protection, sustainable energy sources, muscle development using bio-based materials, traffic, food waste and bioeconomy in politics. The target group of this pilot action are the students at their high school.

4.2.4.6.2 Italy

4.2.4.6.2.1 Living Labs with 4-8-year-olds and 9-13-year-olds

At the first workshop with 4-8-year-olds and 9-13-year-olds in Italy, the exploration phase of the process already commenced. Decisions about the projects that would be pursued were made. From the completed reporting templates, it can be deduced that the participants of the Living Labs with 9-13-year-olds voted for the idea that they would like to follow, namely the educational game. As one the ideas generated from the 4-8-year-olds was board games and it

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had the most “sticky notes”, it can be assumed that the participants of this Living Lab also decided to work together to produce the educational game.

As a next step, the first workshop culminated with tasks for the participants to complete until the next workshop. In particular, this involved tasks to prepare for the second part of the exploration phase – namely, developing prototypes - the participants of the Living Lab with 4-8-year-olds were asked to:

- work with their teachers to consolidate their ideas regarding the educational game into a maximum of two games.
- think and discuss: the goal of the game, who wins? What game actions are necessary for one to win, number of players, is it a collaboration or competitive game? What materials e.g., checkers, dice, various markers etc. are required?
- Involve their parents by taking photos and videos within their neighbourhoods of places where biomass from waste is produced.

In addition to the same tasks stated above for the participants of the Living Lab with 4-8-year-olds, the participants of the Living Lab with 9-13-year-olds were asked to individually think about the role they would play in the game production process i.e. game designer, art designer, maker, communication etc. as well as to work autonomously in class with teacher and at home with parents to define and focus more on the ideas that had emerged.

At the second workshop of the Living Labs with 4-8-year-olds and 9-13-year-olds in Italy, the participants were requested to present the results of their assignment from the previous workshop i.e., final board game ideas in a detailed manner. Two ideas were presented: A memory game and a board game. It is unclear from the reporting template how the decision to produce the board game and not the memory game was reached. Thereafter they were divided into groups and assigned roles to commence with the prototyping. Each group involved a staff member from APRE to moderate the discussions. The roles included:

- Communication & design: Creation of the communication package of the game, designing the posters and cards (draw and paint) and ideas to promote and communicate the game beyond the classroom.
- Crafting materials: first realisation of the materials and the content of the game (billboard, cards, questions, riddles, dice, tokens, sectors and activities of the game)
- Game rules and writing: fine tuning and writing the games’ instruction (goal, number of players, etc.)

The methodology used in this phase involved: The flipped classroom, inquiry-based learning, hands-on learning (production of game materials). At the end of this workshop the participants discussed the steps that had already been achieved and were given an assignment (which was not detailed in the reporting template) for the next session.

In addition to recapping on the stage that the prototype was, in the third workshop with 4-8-year-olds and 9-13-year-olds, APRE team presented a rhyme for the dissemination and communication of the board game that they presented to the participants. They were then given

the rhyme to improve and memorise for the experimentation stage. This followed with the participants being divided into four groups to test and evaluate the final prototype. The ideas collected from the class had been further elaborated (revised, fine-tuned and standardised) by APRE staff after the end of the workshops in order to have a final prototype design to be tested. Each group was provided with a prototype of the game to determine what worked and what didn't. APRE staff continuously supported the students explaining the rules and the development where necessary. In each section of the game, the functioning of the cards, activities and boxed was assessed and feedback or other suggestions for improvement were collected. After this, the participants brainstormed on possible names for the game and voted. The name selected was "sustainable bio-monopoly to save our planet". The participants were given the assignment to finalise the drawings to show at the next workshop. The groups were asked to design and give inputs to elaborate on the whole logic of the game starting from question cards and activities cards, type of participants, until the elaboration of rules. GenB staff constantly assessed the goodness of the ideas and their relation (scientific validity etc.). It was noted that the pupils preferred using own elaborated materials (i.e., with handcraft processes) and contents instead of already proposed solutions and ideas coming from APRE staff.

The objective of the final game idea is to complete a recipe to make a bio-product therefore "making the world more sustainable". This is achieved by exchanging biomasses with other players, extracting biomasses from different areas of the world (city, seaside, countryside, forest), answering questions correctly, transforming biomasses in the biorefinery location, and acting on the various steps where you land on. The participants of the game are people from the bioeconomy sector (i.e., scientist, agronomist, fisherman etc.) who interact with one another on the various steps of the game (e.g., responding to advantages or challenges, collecting additional points, performing activities etc.) which enables them to have the necessary resources and steps taken to produce a bio-based product. It is aimed for children aged between 8 and 13 and they can play with their peers or adults.

The game was developed by both Living Labs starting from the third workshop, since the Living Labs with 4-8-year-olds and 9-13-year-olds expressed similar ideas on what type of game to produce. This was decided to better fine tune the ideas and make them more achievable/standardised for both groups, taking advantage of available GenB resources.

4.2.4.6.2.2 Living Lab with 14-19-year-olds

At the first workshop with 14-19-year-olds in Italy the decision to create an escape game was made. One of the main reasons for this decision was that the escape game due to the fact that it is flexible and comprehensive, would allow embedding the aspects of the other formats proposed: podcast, live demonstrations and chemical experiments. Some students were more familiar and already had the chance to play in some escape games and highlighted the fact that this solution could be the most engaging one in order to involve the audience more actively especially parents who were not available for the co-design phase.

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The concept of the escape game developed by this Living Lab was based on the following narrative: Our planet is trapped in a dangerous linear model of production, consumption and lifestyle... let's find a solution through the Bioeconomy escape game!

At the second workshop, which took place online, FVA presented the participants with an introduction to the escape game concept (key elements, structure, example of enigmas) as well as explained to them how such a game is developed using examples of existing escape games. Tips about how to design quizzes and enigmas, templates and useful links were also provided through the presentation delivered by FVA. Together with the participants, the possible title, scenario, scientific experiments, enigmas, etc. and identification of the contexts in which the escape game will be implemented live were brainstormed using Mentimeter and discussed.

The third workshop of this Living Lab also took place online involving only the FVA team and teachers as the pupils were not able to participate as it took place during the school holidays. This workshop aimed at fine-tuning the main structure, flow, learning contents and quests of the escape game drafted by the team of students-teachers. The session was facilitated with a Miro board in which teachers participating in the meeting validated with FVA the game and defined some of the key experiments to be implemented. Both teachers and students used this shared board to keep on working on the escape game elements that were finalised and validated through three meetings that took place between September and October with FVA team and the class participating in the Living Labs. As a result of this series of workshops, the game titled "Escape4Future - Chemistry meets Circular Bioeconomy" was designed. It will engage 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.
The following section presents a brief description of the learning objectives related to each enigma:

1. 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.
2. 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.
3. 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.
4. Enigma 4: Players will be given 24 numbered cards with information about different renewable feedstock. Nine bio-products will be arranged on the table in a pre-determined 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,

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will form a code that can open a lock on a box containing materials for the next experiment.

5. 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.
6. 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.

The game will be firstly implemented in a physical format and possibly also in a digital one in the future. The exploration stage was completed before the fourth workshop where the experimentation stage took place in the framework of two large-scale events.

4.2.4.6.3 Slovakia

4.2.4.6.3.1 Living Lab with 4-8-year-olds

The exploration stage in the Living Lab with 4-8-year-olds in Slovakia started in the second workshop. Due to the age of pupils, the decision on the format to create, was based on the agreement between the PEDAL team and the third-year teacher. Pupils were offered the opportunity to create their own books, which they would develop as a concept themselves and process the final version on a computer in computer science classes. To determine the themes, the participants referred to the globe poster created in the first workshop (see Chapter 4.2.4.5.3.1) and each group chose its own theme by mutual agreement and with the support of facilitators. The main part of this workshop involved introducing the storytelling methodology to the participants in order to support them in narrating their stories for the books. Additionally, time to start working on the book in terms of content was set aside during this workshop, comprising of the second part of the exploration phase, namely prototyping or “bringing the ideas to life”.

One class (grade 1) decided not to continue with the process and developed simple prototypes during the second workshop which this marked the end of the Living Lab process for this class.

In the other class (grade 3) of the Living Lab with 4-8-year-olds, unfortunately, the teacher involved could not continue with the Living Lab process as previously discussed (production of the digital version in the computer classes) due to health issues and as a result, the pupils were instructed to prepare simple stories based on what they had learnt in this and the previous workshop. To enable this, their memories on the topic were refreshed through being played a

music video on the topic as well as the “What’s bioeconomy book” to illustrate the topics explained.

In the period between the second and third workshops, the participants worked in groups on their proposed ideas, aiming to create "books" consisting of explanatory text and illustrations. They were guided by their teacher to prepare a series of books related to topics from the previous workshops. Unfortunately, due to the teacher's health issues and school trips at the end of the year, the students couldn't complete their work in time for the planned experimentation phase on the 15th of June 2023. Only three pupils participated in the event with a different project (a poster). The third workshop for the third-grade class was therefore rescheduled to the 23rd of June 2023, and it took place in the classroom and not as part of an exhibition at the leisure centre as previously planned.

4.2.4.6.3.2 Living Lab with 9-13-year-olds

At the second workshop of the Living Lab with 9-13-year-olds in Slovakia the exploration phase of the Living Labs commenced. This was initiated by the decision on the project ideas the participants wanted to pursue further from the portfolio of ideas that they had come up with. They decided to develop comic books and posters. As both ideas were complementary and no other ideas had been developed, it was decided to continue with both ideas. The topics of the comic books and posters are as follows:

1. **How climate change occurs and the role of humanity**: This project aimed to explore the causes and consequences of climate change, as well as the ways human actions contribute to this global issue.

2. **The contribution of the circular (bio)economy to the fight against climate change**: This project delved into the concept of the circular bioeconomy and its potential in mitigating climate change by reducing waste and promoting sustainable practices.

3. **Examples of human behaviour as consumers with lower negative environmental impact**: The students intended to showcase sustainable consumer behaviour examples that lead to reduced negative environmental impacts, such as eco-friendly purchasing and waste reduction.

4. **The bioeconomy in our daily lives**: This project aimed to highlight the bioeconomy's presence in various everyday products and activities, demonstrating how it impacts our lives positively.

The lab team guided the students through the storytelling method to help them structure their projects effectively and ensure that their messages were communicated clearly. By the end of the workshop, each group had a well-defined idea for their project and a clear direction on how to proceed. The participants were asked to talk to parents and get feedback on the projects between workshop two and three as well as continue working on their projects with the aim of

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bringing them to life by the third workshop. Hence the exploration phase ended in the time between the two workshops.

4.2.4.6.3.3 Living Lab with 14-19-year-olds

The exploration phase of the Living Lab with 14-19-year-olds in Slovakia started in the period between the first and the second workshop where the pupils were given the assignment to decide on which project ideas they would like to pursue and whether they would like to undertake this as a group or in smaller groups.

The second workshop of this Living Lab aimed at refining the group's project idea, namely a game inspired by the game monopoly. Through design thinking methodology the participants were encouraged to think critically of their needs and preferences, the objective, target audience, rules and visuals of their game. The participants recognised that the complexity of the game required expertise beyond their current knowledge, particularly in the areas of green business and environmental issues. They expressed the need for collaboration with experienced professionals, reflecting their desire for accuracy and effectiveness in the final product.

By the end of the second workshop the participants had set the stage for the next processes including roles and responsibilities with the aim of having a prototype of the game by the next workshop which was the experimentation phase of the process. It was agreed that they would create a test version by the next workshop through iterative prototyping and collecting and building in feedback from peers and family. This means that this exploration stage for this Living Lab was completed in the time between the last two workshops of the Living Lab process, workshop two and three.

4.2.4.6.4 Commonalities and strengths

1. **Objective of exploration phase**: In all three countries (Austria, Italy, Slovakia), the exploration phase involved deciding on project ideas to pursue and creating prototypes to bring those ideas to life.

2. **Emphasis on group collaboration:** Participants in all countries work in groups or teams to develop their project ideas and prototypes, emphasising collaborative learning and co-creation.

3. **Task assignment**: Participants in all age groups were assigned specific tasks and roles related to their project ideas during the exploration phase. This helps distribute responsibilities and ensures everyone contributes to the project.

4. **Feedback**: In all three countries and for all age groups the participants were requested to draw feedback from e.g., their peers and families and based on this feedback, improve the project/product being developed.

5. **Empowerment of the participants with regards to methodologies**: In all three countries the participants were taught different methodologies to help them with the exploration phase. In Austria for example the participants of the Living Lab with 14-19-year-olds were taught about the elevator pitch, in Slovakia participants of the two younger age groups were taught about storytelling while those of the older age groups were taught about design thinking. In Italy methods such as: The flipped classroom, inquiry-based learning, hands-on learning, were introduced to the participants.

6. **Pursued project ideas**: In both Italy (all age groups) and Slovakia 14-19-year-olds the projects selected involved creating games. With the younger groups in Austria and Slovakia the projects involved among others the creation of posters, books and magazines.

4.2.4.6.5 Disparities and complexities

1. **Timing and sequence**: The timing and sequence of the exploration phase differed among all three countries and between the age groups.
   - **1.1 Austria**:
   - **1.1.1 Living Labs with 4-8-year-olds:**
     The exploration phase for the Living Labs with 4-8-year-olds in Austria took place outside of the three planned workshop. Specifically, it took place between the second and the third workshop.
   - **1.1.2 Living Lab with 9-13-year-olds:**
     Like with the younger age group in Austria, the exploration phase took place outside of the workshops with the difference being that this phase for this Living Lab already started in the period after the first workshop.
   - **1.1.3 Living Lab with 14-19-year-olds:**
     The exploration phase for this Living Lab also started in the period after the first workshop and before the second workshop. At the second workshop, this phase continued in the workshop setting and was finalised in the period between the second and third workshop.

2. **Italy**
   - **2.1 All Living Labs:**
     The exploration phase of all Living Labs in Italy unlike in the Austrian Living Labs, which primarily took place in the period between the workshops (except for 14-19-year-olds), groups primarily took place within the workshop settings. In fact, in Italy the Living Lab process involved four workshops compared to three workshops in Austria and Slovakia and also as suggested by the guideline so as to ensure that the prototyping took place within the workshop settings. This phase also started for all Living Labs in Italy within the first workshop.

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3. **Slovakia**
   - **3.1 Living Labs with 4-8-year-olds and 9-13-year-olds:**
     Both the exploration phase of the Living Labs with the two younger age groups in Slovakia started within the second workshop and continued and was finalised in the period between the second and the third workshop.
   - **3.2 Living Lab with 14-19-year-olds:**
     The exploration phase of this Living Lab started in the period between the first and second workshop, was continued within the second workshop and was completed in the time between the second and the third workshops.

4. **Role of the workshop moderators**:
   - **4.1 Austria**: In Austria the workshop moderators played only a facilitating role in terms of guiding how the different Living Lab phases should take place. As the actual implementation of these phases to a great extent took part outside of the workshops, the moderators had little to no influence of the project selection or project idea development. With the Living Lab with 14-19-year-olds where a big chunk of the exploration phase took place within the second workshop, the moderators played only a facilitating and advisory role making sure that the participants were equipped with the tools to co-create and had knowledge on the topic.

   - **4.2** Italy: In Italy the role of the workshop moderators in the exploration phase was relatively high. Not only were the moderators involved in the ideation stage, but they were also actively involved in the development of project ideas. For example, in the Living Labs with the two younger age groups, the moderators independently created dissemination and communication material and presented it to the participants who then had the opportunity to improve them. Furthermore, APRE team produced the prototypes for experimentation based on the discussions and ideas of the participants. For the Living Lab with the 14-19-year-olds, FVA was also very active in supporting the students and teachers in the idea selection and development. After the decision on pursuing the escape game FVA provided the participants at the second workshop with information about the concept of the escape games and how they could be developed and remained actively involved in the development of the final product by the Living Labs participants.

   - **4.3** Slovakia: The role of the workshop moderators involved both Austria's and Italy's stance. For the Living Lab with the youngest age group, the workshop moderators, like in Italy were very active in the decision of the projects to be pursued as this was decided together with the teacher. For the other age groups, the workshop moderators in Slovakia took on a similar stance as the Austrian moderators in that their role was mainly to facilitate the co-creation process and less to get mixed up in the decision making and project development activities.

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5. **Diversity of project ideas**: The Austrian Living Labs (all ages) are the only ones that decided to produce numerous products. In Italy and Slovakia, each Living Lab produced a single well-structured product. However, in Slovakia this was slightly different in that the Living Labs with the younger age groups decided on one format each, however, the contents or the final projects were numerous i.e., a number of (comic) books and posters on different topic. The oldest age group of the Living Labs in Slovakia decided to collectively work on a single game which is the case of the age counterparts in Italy. The two Living Labs with the younger participants in Italy decided to collectively work on a single idea, i.e., both Living Labs worked on the same educational game.

4.2.4.7 Experimentation of pilot projects & project presentation

4.2.4.7.1 Austria

4.2.4.7.1.1 Living Labs with 4-8-year-olds and 9-13-year-olds

The final phase of the Living Labs started with the so-called content experimentation, where the projects as results of the Living Labs were presented.

Since in Austria the Living Labs for the elementary and primary students took place in the same school, the project experimentation took place in one common showcase event. One by one starting from the first grade, representatives of the classes, who had been previously selected, came to the front and shortly presented their final products/projects to the entire school. This helped the students gain experience in public speaking and presentation skills and also demonstrated their learning by showing tangible products that resulted from it. As the audience included also other students and staff who were not part of the process, these presentations exhibited a form of accomplishment for not only those who presented the final products and projects, but also all those that were involved.

The students in the Living Labs with 4-8-year-olds presented the following products:

- Flowerpots and purses crafted from recycled tetra packs and fabric remnants

Figure 2: Product from Living Labs with 4-8-year-olds - Flowerpots and purses from recycled tetra pack

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- Pencil cases from repurposed plastic bottles

Figure 3: Product from Living Labs with 4-8-year-olds in Austria - Pencil case from repurposed plastic bottles

- Bags from fabric remnants

Figure 4: Product from Living Labs with 4-8-year-olds in Austria - Bags from fabric remnants

- Photo frames decorated with buttons

Figure 5: Product from Living Labs with 4-8-year-olds in Austria – Photo frame embellished with buttons

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- Poster showcasing ideas for products derived from biobased materials.

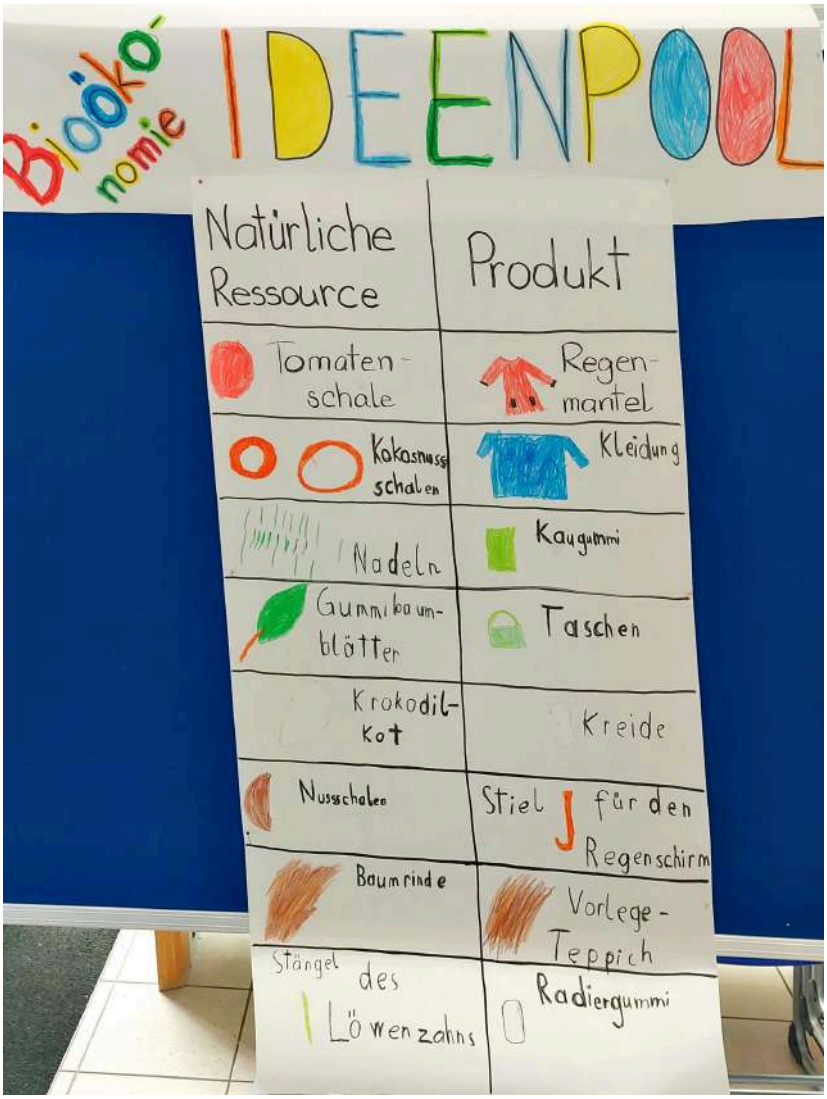

Figure 6: Product from Living Labs with 4-8-year-olds in Austria Poster showcasing ideas for products derived from biobased materials

Students from the Living Lab with 9-13-year-olds presented their self-developed and designed bioeconomy magazine and a series of informative videos on various aspects of the bioeconomy [Austria, ZSI, WS3, 4-8-year-olds & 9-13-year-olds].

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Figure 7: Product from Living Lab with 9-13-year-olds in Austria – Bioeconomy magazine

Figure 8: Product from Living Lab with 9-13-year-olds in Austria – Series of informative videos on various aspects of (circular) bioeconomy

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After the presentation of the final projects and products, each of the classes that participated in the Living Labs came into the exhibition hall one by one to look at the display as well as all the products presented in more detail. These products and projects were as a result of the Living Labs, which in general can be said to have taken to have been created as part of their project-based learning experience. Project-Based Learning is an educational approach that centres around students working on in-depth projects that are aligned with curriculum goals and involve solving real-world problems or addressing meaningful questions. The pupils were quite intrigued and excited about visiting the different displays. In some cases, some comments could be heard about how some things could have been created differently by pupils from other groups. In particular, one could feel the pride that the pupils exuded especially when visiting their own displays. The classes that did not participate in the Living Labs process had the chance to visit the exhibition at a different time as time did not allow this to be done while the ZSI staff were present.

During the exhibition run, ZSI staff had the opportunity to talk to the participants and find out how the last part of the exploration process that was done in their absence after the second workshop took place i.e. how did they decide on the products to create if this was not certain at the second workshop, how did they go about dividing the responsibilities - who did what, how did they involve their families and other people if at all. These questions were not only aimed to help ZSI staff understand what had taken place between the second workshop and the last, but was also geared towards encouraging the pupils to critically think about their own learning journeys, the dynamics of teamwork and to increase awareness of the collaboration that took place as well as to encourage the pupils to recognise and appreciate their efforts and outcomes [Austria, ZSI, WS3, 4-8-year-olds & 9-13-year-olds].

4.2.4.7.1.2 Living Lab with 14-19-year-olds

In the secondary school Living Lab in Austria three projects had been realised among the participants and for two of them, one representative was chosen by the group to present the final project, while for the remaining one, all the members of the group that were present at this session, presented the final project collectively. After each presentation, the audience was given a chance to ask questions and here ZSI staff took the opportunity to ask about what had happened since the previous workshop, how the tasks were divided among the group members, which other stakeholders were involved and in what way etc. This process helped the students gain experience in public speaking and presentation skills and also demonstrated their learning by showing tangible projects that resulted from it. As the audience included the participants from the other groups, who were yet to see or hear about the final projects as well as the teacher and ZSI staff present, these presentations exhibited a form of accomplishment for not only those who presented the final projects, but also all those that were involved. Also, the feedback and suggestions provided in this session were key to this stage of the Living Labs which is the experimentation stage aiming at gaining feedback and adapting the projects where need be. The

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discussions session after each workshop also added to the interactive character of the workshop [Austria, ZSI, WS3, 14-19-year-olds].

The students presented the following projects:

- **A series of educational videos** covering various aspects of the bioeconomy:
  - Influence of media on the bioeconomy
  - Sustainable fashion
  - Economic consequence
  - Packaging
  - Transport bioeconomy
  - Sustainable beverages
  - Food waste
  - Sustainable food and training
  - Avoiding microplastics
  - Sustainable energy resources
  - Climate change

Figure 9: Product from Living Lab with 14-19-year-olds in Austria – Educational video series various aspects of (circular) bioeconomy

- **Elementary school education**: Teaching an elementary school class about the bioeconomy through theory and hands-on experiments.

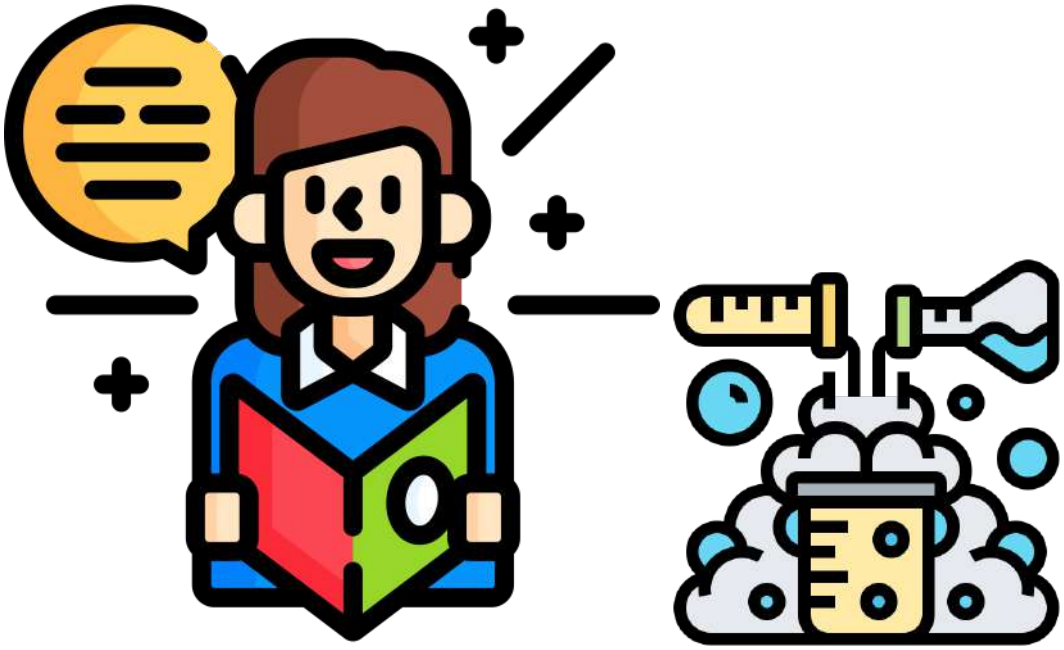

Figure 10: Product from Living Lab with 14-19-year-olds in Austria – Elementary school education

- **Sustainable packaging advocacy**: Sending an information email to the head of a supermarket chain addressing packaging reduction and the potential use of bio-based packaging.

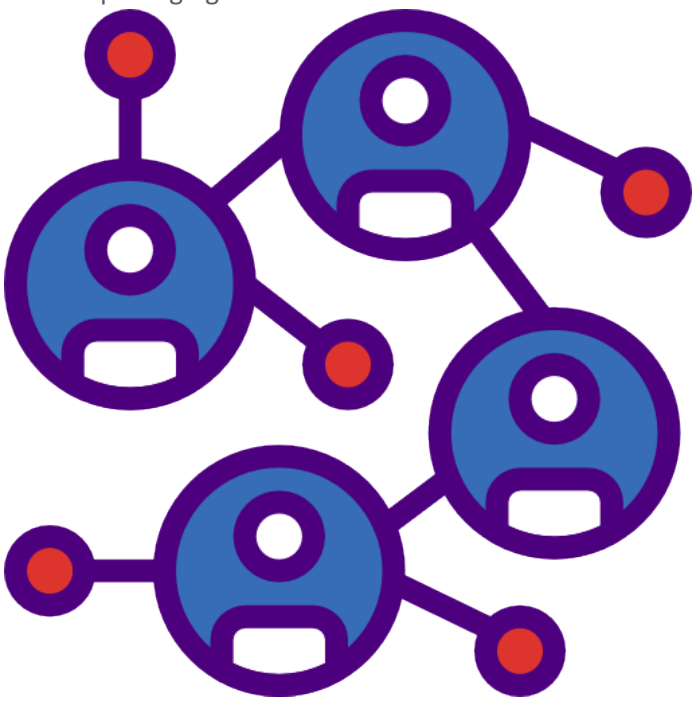

Figure 11: Product from Living Lab with 14-19-year-olds in Austria – Sustainable packaging advocacy

It was particularly important for ZSI staff to appreciate and acknowledge the students' efforts at the beginning of the discussion session as well as at the end so that on one hand they could

recognise their efforts and outcomes and on the other hand so that they could be able to take any constructive feedback better [Austria, ZSI, WS3, 14-19-year-olds].

4.2.4.7.2 Italy

4.2.4.7.2.1 Living Labs with 4-8-year-olds and 9-13-year-olds

In Italy another approach for the third workshop was taken. During the third workshop of the 4-8 and the 9 -13-year-old students the experimentation phase started within the Living Lab by the students assessing the prototype of the board game and improving it to be implemented to be tested with the general public in the fourth workshop. The class was divided into four groups to test and evaluate the prototype. The students had to play the game and see what worked and what did not work. APRE staff continuously supported students explaining the rules and the development, where necessary. In each section of the game, the functioning of the cards, activities and boxes was assessed and feedback or other suggestions for improvement were collected. Furthermore, new ideas and contents of the game were produced based on students' preferences and inputs. At the conclusion of the workshop a brainstorming on the project name took place. The name preferred by the 4-8-year-olds was "sustainable bio-monopoly to save our planet". The homework given for the fourth and last workshops was the finalisation of the drawing for the board game and the preparation of groups and tasks for the final event (I.e., rehearsing the rhyme, explaining the bioeconomy and the phases of the workshop etc.,) [Italy, WS3, APRE, 4-8-year-olds; Italy, WS3, APRE, 9-13-year-olds.

Additionally, the four groups in the workshop with the 9-13-year-olds were assigned roles (i.e., communication of the game, writing rules, etc.) and one APRE facilitator moderated each group. Then time for communication and design of the board game was taken and the communication package of the game was created, billboards and cards were designed as well as ideas to promote and communicate the game beyond the classroom were collected. After that materials and the content of the game (billboard, cards, questions, riddles, dice, tokens, sectors and activities of the game) were realised, and the games instructions were fine-tuned and written. During this phase innovative formats were used, like flipped classroom, inquiry-based learning and hands-on learning. Finally, the final pilot output was presented by the class. The board game was detailed with number of participants, target age group rules, mechanism and materials needed to create the prototype. The tentative title was "saving nature" [Italy, WS3, APRE, 9-13-year-olds].

The final results of the Living Lab were presented in the fourth workshop, which took place in the framework of an open school event ("sustainability day"), where parents, external bodies and institutions were invited. The aim of the final workshop was to show the final output attendants of the event as well as to continue evaluating the contents and collecting feedback from parents and other multipliers. For the presentation of the game, the class was divided into four groups, each presenting a different aspect of the Living Lab:

- Group 1 explained in their own words what the bioeconomy is, why it is important, and the main concepts they remembered.

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- Group 2 read the rhyme to communicate the educational game.
- Group 3 explained the phases of the Living Labs and what they had done during the various workshops.
- Group 4 played and demonstrated the game.

The final result of the Living Labs with the 4-8 and the 9-13-year-olds in Italy is the prototype of the Bioeconomy game. "The aim of the board game is teaching the bioeconomy to other students, aged 8 to 13 years, while playing with other peers or with adults. The objective of the game is to transform a biomass into a new bio-based product. This is achieved by finalising a biobased recipe through exchanging biomasses with other players, extracting biomasses from different areas of the world (city, seaside, countryside, forest), answering correctly to questions, transforming biomasses in the biorefinery location, and acting on the various steps where you land on. The participants of the game are people from the bioeconomy sector (i.e., scientist, agronomist, fisherman etc.) who interact with one another on the various steps of the game (e.g., responding to advantages or challenges, collecting additional points, performing activities etc.) which enables them to have the necessary resources and steps taken to produce a bio-based product." [Italy, WS4, APRE, 4-8-year-olds; Italy, WS4, APRE, 9-13-year-olds]

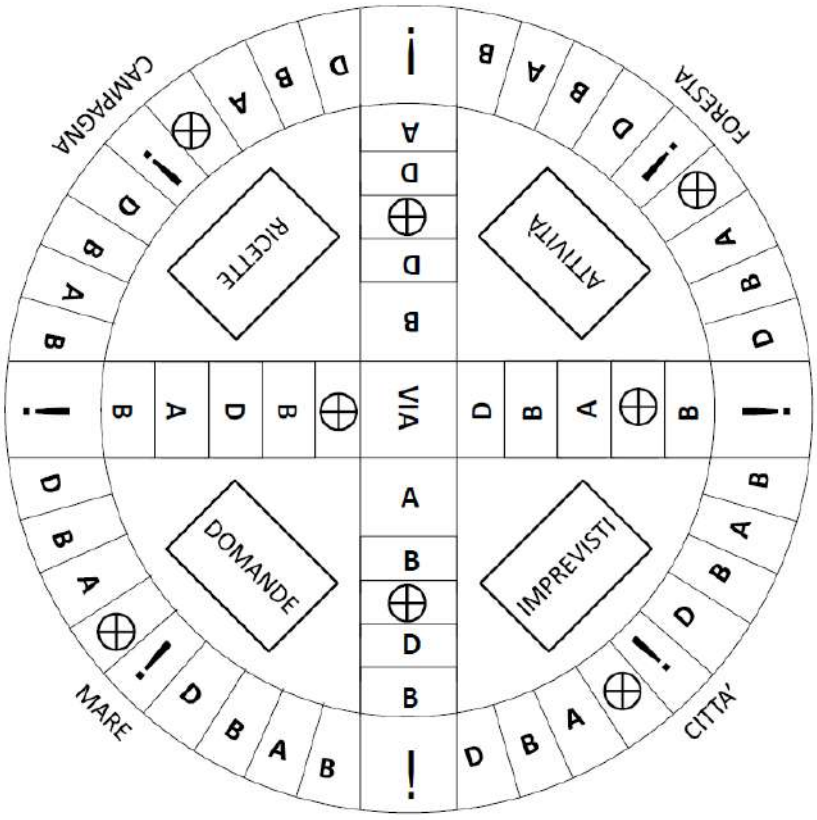

Figure 12: Product from Living Lab with 4-8 and 9-13-year-olds in Italy – Bioeconomy board game

4.2.4.7.2.2 Living Lab with 14-19-year-olds

The fourth workshop of the secondary school Living Lab in Italy, which also represented the experimentation phase of the Living Labs process, took place in the context of the Maker Fair in Rome and the "Fermhamente" in Fermo with the aim to collect feedback from the attendees and validate the format with a larger audience. The Escape Game developed in the Living Lab participants (please see exploration phase of this Living Lab for more details on the product under Chapter 4.2.4.6.2.2) was played by groups of students, parents and teachers, in nine different slots. At Maker Faire the escape game was played 5 times involving around 50 youngsters above 14 years old and 5 parents actively engaged throughout the experience. In Fermhamente a more simplified version of the escape was played 5 times by around 80 youngsters, that was more similar to an experiential didactical game, where the Living Labs students facilitated a lot the players in solving the different enigmas, while explaining the educational concepts behind each experiment (Students2Students format). This was because the age of the participants was very heterogeneous, involving also primary school students and their parents. The escape game was in fact originally designed targeting mostly teenagers and young adults and the different enigmas and experiments were too challenging for a younger audience. During the Fermhamente festival, there was the highest percentage of parents involved in the game (around 120). Additionally, an evaluation form was prepared to collect feedback from the players and another one for the Living Lab students to grab their recommendations for the deployment of the game, since they were the actual facilitators.

In total, during the 2 large-scale events, the Escape4Future game involved more than 140 students, around 120 parents and 7 teachers.

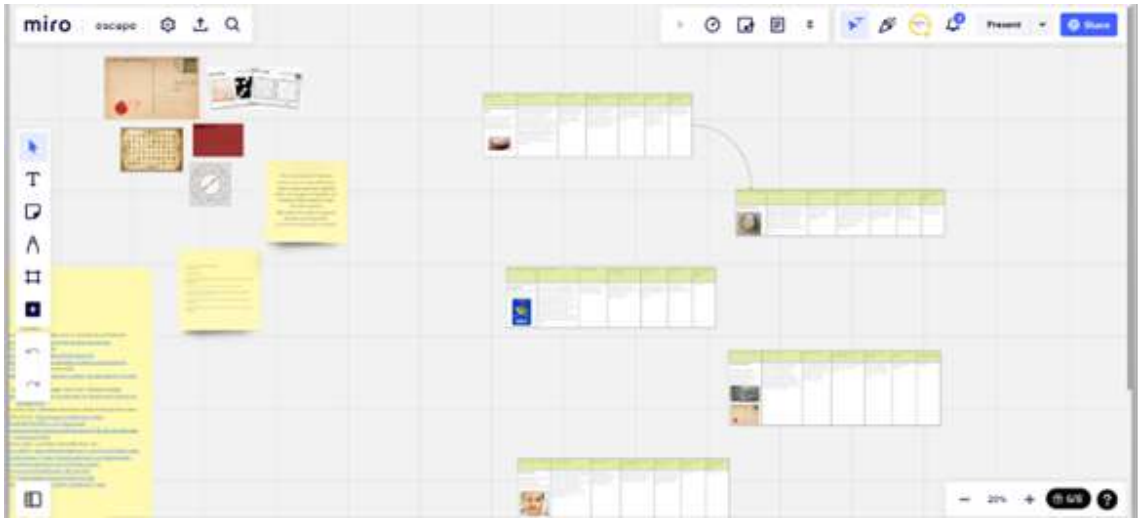

Figure 13: Product from Living Lab with 14-19-year-olds in Italy – Escape game "Escape4Future"

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4.2.4.7.3 Slovakia

4.2.4.7.3.1 Living Labs with 4-8-year-olds and 9-13-year-olds

In Slovakia the final workshop for all three age groups was planned to take place in the framework of an exhibition organised by the Gessayova Leisure Centre. Unfortunately, due to the health problems of the teacher and end-of-year school trips, the 4-8-year-old pupils did not have time to prepare their work in time and only three of them were able to participate with a poster, which was another project than initially planned. Therefore, the last workshop for the youngest age group took place separately in school, where pupils presented their projects to each other. They introduced their topics and explained to the other groups what they had covered in the booklets and brochures participants (please see exploration phase of this Living Lab for more details on the products under Chapter 4.2.4.6.3.1) and why they chose their topics [Slovakia, PEDAL, WS3, 4-8-year-olds].

Figure 14: Product from Living Lab with 4-8-year-olds in Slovakia – Series of brochures and booklets on various aspects of the bioeconomy, climate change and sustainability

Also, the students of the age group 9-13-year-olds presented their completed projects during their last workshop in their school, focusing on different aspects of the bioeconomy and its positive impact on the environment. The topics addressed in the comic books and posters

produced by the participants (please see exploration phase of this Living Lab for more details on the products under Chapter 4.2.4.6.3.2) included:

- How climate change occurs
- The role of humans in the process of climate change
- The bioeconomy around us and waste sorting and recycling

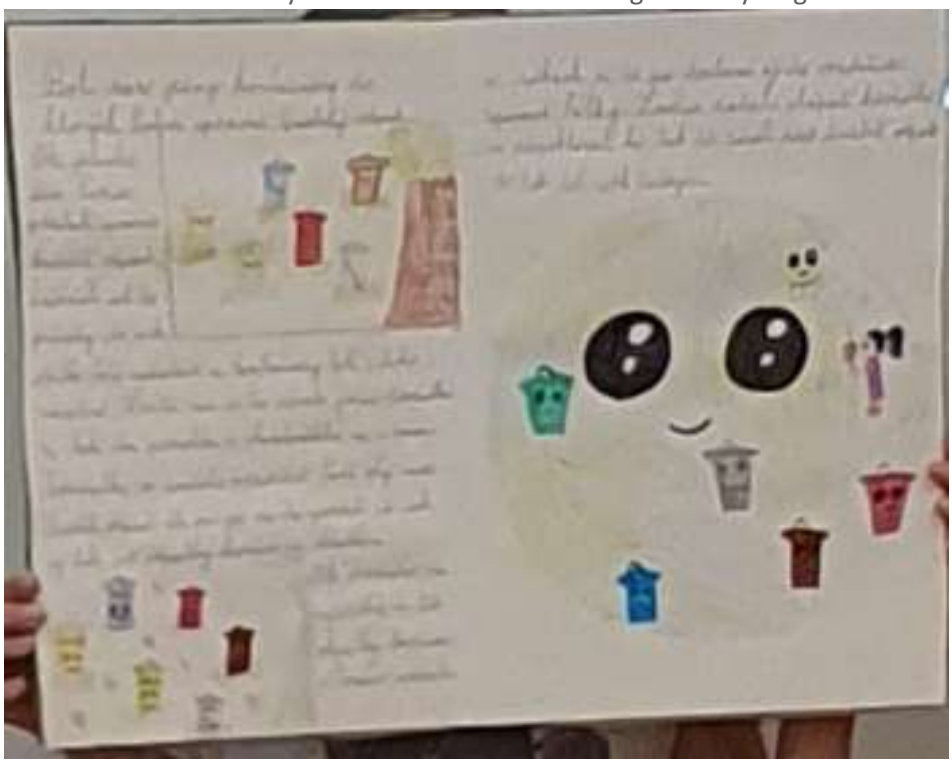

Figure 15: Product from Living Lab with 9-13-year-olds in Slovakia – Series of Comic books and posters on various aspects of the bioeconomy, climate change and sustainability

After each presentation, the rest of the class provided feedback and engaged in discussions related to the presented topics. This fostered a supportive and interactive learning environment, encouraging students to share their thoughts and insights. The workshop showcased the students' creativity, critical thinking, and understanding of the various approaches, such as circular economy, the importance of bioeconomy in addressing climate change and environmental challenges and provided an opportunity for students to take part in building a greener future [Slovakia, PEDAL, WS3, 9-13-year-olds].

4.2.4.7.3.2 Living Lab with 14-19-year-olds

The third and final workshop of the age group 14-19 in Slovakia focused on presenting and evaluating the board game developed by the high school students (see the exploration stage for more details on the game Chapter 4.2.4.6.3.3). The workshop took place during an exhibition organised by the Gessayova Leisure Centre, providing an opportunity for the participants to showcase their work to a broader audience, including visitors, parents, and other students. The workshop was started with an introduction to the exhibition and its purpose. The main part of the workshop was the presentation of the board game concept to the audience, which was done

by four high school students, representing the whole group involved in the Living Lab process [Slovakia, PEDAL, WS3, 14-19-year-olds].

Figure 16: Product from Living Lab with 14-19-year-olds in Slovakia – Board game inspired by the game MONOPOLY

4.2.4.7.4 Commonalities and strengths

One important strength of the final workshop in Austria for the elementary and primary students was that representatives of each class were given the opportunity to present their final projects and products to the entire school. This helped the students gain experience in public speaking and presentation skills and also demonstrated their learning by showing tangible products that resulted from it. As the audience included also other students and staff who were not part of the process, these presentations exhibited a form of accomplishment for not only those who presented the final products and projects, but also all those that were involved [Austria, ZSI, WS3, 4-8 and 9-13-year-olds]. Also, with the secondary students the project showcase to their peers and Q&A also generally worked well. It provided the participants who presented their projects with experience in presenting to an audience i.e., public speaking. As they had worked in groups, the different groups came to know the final projects of the other groups at this event. This was also the case for the teacher and ZSI staff [Austria, ZSI, WS3, 14-19-year-olds].

The appreciation by ZSI staff at the opening presentation as well as the recognition and certification were particularly important and worked well in reinforcing the pupils' contributions and efforts in the whole process [Austria, ZSI, WS3, 4-8 and 9-13-year-olds]. This was also true for the Living Lab with the secondary students in Austria. The appreciation of the participants' efforts throughout the process fed into the positive learning atmosphere and encouraged them to recognise their own learning and effort and also understand that any questions and feedback resulting from their presentations were meant to improve their ideas and processes [Austria, ZSI, WS3, 14-19-year-olds].

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The exhibition run and visiting the different displays was intriguing and exciting for the students [Austria, ZSI, WS3, 4-8 and 9-13-year-olds]. The fact that this was organised as a school activity ensured that the audience also included pupils and staff members who were not part of the process which was particularly exciting to the participants of the Living Labs as they could show off what they had created. Pupils were also especially pride when visiting their own displays. Since the exhibition was organised by class and not by Living Lab, this gave also each class some sense of pride [Austria, ZSI, WS3, 4-8 and 9-13-year-olds].

The fact that after the main showcase each class had an opportunity to go through the exhibition and look at everything on display in more detail was an added value as on one hand they were able to possibly admire and learn from the others' creation and on the other hand had time to reflect on the process especially the time between the second and third workshop with ZSI staff [Austria, ZSI, WS3, 4-8 and 9-13-year-olds].

The pupils and teachers organised the auditorium in a very nice manner in that not only the final projects and products were displayed, but each class had its own display not only including their final projects and products, but also other related materials e.g. the books gifted to them in the first session, the pictures drawn in the first and second sessions and new pictures and posters created in the time between the second and third workshop. This created a very visually pleasing exhibition and at the same time, with the videos of the older pupils not being showcased in the exhibition run, the class still had a display where one could grasp a sense of what they had learned throughout the whole process.

The workshop with regards to timing, setting etc. worked seamlessly as it was organised and decided upon internally with the agreement and knowledge of all the staff and pupils involved. They set-up the space the day before to ensure that everything that needed to be displayed was displayed and to save on time [Austria, ZSI, WS3, 4-8 and 9-13-year-olds].

4.2.4.7.5 Disparities and complexities

Challenges mentioned in relation to the experimentation workshops of the Living Labs on the one side related to the timing. Since it was at the end of the school year also other events were planned and implemented in these last weeks of the school. In the Austrian Living Labs of the 4-8 and 9-13-year-olds preparations of the summer celebrations took place on the same day. As a result, there was no time allocated for the audience to ask questions during the showcase, due to the limited time and structure. In addition, there was a relative long wait between the exhibition runs of the different classes as we had to wait for them to wrap-up the preparations and some of the exhibition runs were a bit rushed. These preparations also caused that there was not enough time for the classes that were not part of the Living Labs to have an exhibition run in the presence of ZSI staff, which could have possible given ZSI staff a better idea of how the projects and products were received [Austria, ZSI, WS3, 4-8 and 9-13-year-olds].

In the Austrian Living Lab of the 9-13-year-old students one of the fourth grader classes took part. They were able to produce great videos on the topic. However, this being their last week in the school, further work on the project or topic was not in question [Austria, ZSI, WS3, 9-13-year-olds].

Another challenging aspect was related to technical issues. The beamer and speaker for the showcase of the videos created unfortunately did not work very well as it was not tested before and thus the visuals and sounds were not appropriate for the setting as it was both difficult to see and understand what had been created. As a result, it was not possible to show off the videos during the exhibition run [Austria, ZSI, WS3, 4-8 and 9-13-year-olds].

Another aspect that did not work well in the final workshops of the Austrian secondary school Living Lab was that for two of the projects it was clear that the groups had not previously discussed and decided how the showcase would take place or who would present. However, it was possible for one member from each group to volunteer to do the presentations quite spontaneously.

Furthermore, since on class decided to produce educational videos individually, by the time of the workshop not all the videos were complete nor collated together. They were also only saved on one of the student's phones and hence it was a bit technologically challenging to share them so that all the participants could see and hear. However, this worked pretty well in the end and also the class teacher shared all the videos edited into one with ZSI staff [Austria, ZSI, WS3, 14-19-year-olds].

4.2.4.8 Project evaluation

At the end of last workshop of the Austrian Living Labs with 4-8 and the 9-13-year-olds, the pupils had the opportunity to rate how they enjoyed the Living Lab process in general as well as the individual stations. Each of the five classes involved in the Living Labs had separate evaluation sheets. Smileys indicating different levels of satisfaction with the Living Labs process as a whole and the individual stations of the second workshop as well as sticky dots were used to gather feedback from the participants. The simplicity and the visual element were aimed at collecting valuable feedback in an engaging and interactive manner. The nature of placing the sticky dots to the corresponding smileys encourages active engagement and participation. The smileys as well as pictures from the different stations from workshop two provided clear visual cues. This method turned out to be rather inclusive as when the participants were asked to describe what they liked or did not like in the process. They were quite shy, therefore this opportunity provided them a sense of anonymity as the sticky notes couldn't be traced back to the person who placed them there, therefore encouraging honest feedback and at the same time accommodated those who did not feel comfortable about expressing themselves verbally – which was more or less all of them. Additionally, the fact that they were given the opportunity to rate the process and the activities gave them a sense of importance that their opinions were welcome and valid [Austria, ZSI, WS3, 4-8 and 9-13-year-olds].

In general, 76,6% of the Living Labs participants in this school liked the Living Labs process. 21,2% were neutral, while 3,5% did not take part in the evaluation. None of the participants indicated not liking the process, i.e., no sticker was placed in any of the columns with the sad smiley face. For the first Living Lab with 4-8-year-olds, 60,5% liked the process, while 32,4% were neutral. 5,9% did not take part in the evaluation. For the second Living Lab with 4-8-year-olds, all the pupils indicated having liked the process. For the Living Lab with 9-13-year-olds, 81% of the participants liked the Living Labs process. 20,6% were neutral and one participant did not take part in the evaluation [Austria, ZSI, WS3, 4-8 and 9-13-year-olds].

Also, the teachers got the opportunity to feedback their opinion regarding the Living Labs. After the third workshop, ZSI staff gave the teachers a feedback questionnaire, to get their views on the whole process. The completed questionnaires still are awaited. The questions included: [Austria, ZSI, WS3, 4-8 and 9-13-year-olds].

- What did you like about the Living Labs?
- What did you not like as much? What could be done better?
- Will you continue tackling the topic of bioeconomy with your class? If yes, in what way?
- Were other people outside the school involved in the projects (e.g., parents, local government)? If yes, who and in what way?
- How did you feel about the development and implementation of the class projects? Where would you have needed support?
- Did the bioeconomy project have an impact on the students? E.g., curiosity towards the topic, awareness raising, teamwork, etc.
- Is there anything else you would like to tell us about the preparation, implementation and conclusion of the workshops?

At the last workshop ZSI staff also took the opportunity to thank all the participants for their contribution, input, effort and hard work in participating in all the workshops as well as achieving their final projects and products. In this way, the pupils' dedication, collaboration, creativity and tangible outcomes were celebrated in front of their peers and teachers. This was aimed at giving them recognition in that they felt valued and recognised for their contribution, hence motivating them for future projects, giving them positive reinforcement and fostering comradery among all the participants of the Living Labs. Furthermore, the participants were appreciated and commended for their efforts throughout the whole process by being awarded with a certificate. This was not only meant to provide the participants with a sense of accomplishment, but also to motivate and encourage them to continue building their interest and knowledge on the topic of (circular)bioeconomy. The certificate communicated to them that they have been noticed, are valued and celebrated – which is positive reinforcement to learning [Austria, ZSI, WS3, 4-8 and 9-13-year-olds].

For evaluating the Living Lab process with the secondary school students in Austria more time and activities were dedicated within the third workshop than for the younger ones. Hence, the participants were invited to a Flipchartwalk, where they went around the room where posters

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with different evaluative elements had been hang. They were given pens so that they could answer the questions for themselves. After this exercise, one of the ZSI moderators went through all the feedback with the group and the group was then asked if they had anything to add. Additionally, more feedback was collected through a Mentimeter questionnaire designed by ZSI staff [Austria, ZSI, WS3, 14-19-year-olds].

In Slovakia the evaluation in the last workshop of the Living Lab with the 9-13-year-olds consisted of two parts: [Slovakia, PEDAL, WS3, 9-13-year-olds]

1. **Quiz and prizes**: To reinforce the knowledge gained throughout the workshops, an online quiz was conducted. Students enthusiastically participated in the quiz, and small prizes (bottles and pens from bio-based plastics, notepads from elephant poo paper) were awarded to the most successful participants, as well as to students who had outstanding projects.
2. **Group discussion and feedback collection**: The workshop concluded with a group discussion, where students shared their overall impressions regarding the Living Lab process and the topic of the bioeconomy as well as their feelings about the possibilities of taking initiative to create a sustainable future. The students' feedback helped to better understand their perspectives to assess the impact of the Living Lab on their understanding of environmental issues and the bioeconomy.

Also, in the final workshop in Slovakia there was a focus on evaluating the Living Labs. On the one side the board game developed by the students was evaluated. Visitors of the showcase event were asked to provide feedback on the board game concept. On the other side, after the project presentations, informal discussions and interviews with the participants were in conducted individually and in group. The questions focused on gathering general feedback and evaluating the participants' experience with the Living Lab process. The participants of the Living Labs were also inquired about the difficulties they faced during the project development [Slovakia, PEDAL, WS3, 14-19-year-olds].

4.2.4.8.1 Commonalities and strengths

In the Austrian Living Lab of the high school students the process inquiry during the Q&A part of the showcase worked well as it was received positively, and the participants were willing and excited to share how the final projects came to be. The also took the feedback very positively. Time was set out to discuss the presented final projects after each presentation. This was a very open discussion where constructive feedback was given and taken as well as suggestions for improvement or further development. As a result, the goal of reflecting whether the final projects met the intended goals was met [Austria, ZSI, WS3, 14-19-year-olds].

In the Slovak Living Lab of the high school students the interactive nature of the Living Labs was highly appreciated by the participants. The use of brainstorming sessions, interactive exercises, and group interviews encouraged active participation and open communication. This approach

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allowed the participants to freely express their ideas and opinions, leading to meaningful discussions and insights [Slovakia, PEDAL, WS3, 14-19-year-olds].

4.2.4.8.2 Disparities and complexities

In the Austrian primary and elementary Living Labs some children did not participate in the evaluation. It seems that children not being present in Workshop 2 did not feel like they could take part in the evaluation activity. Furthermore, since all the pupils had to take turns to make their evaluations, at the beginning there was a bit of shoving and pushing, which in most cases could be quickly controlled by the ZSI moderator and the teachers present with clear instructions [Austria, ZSI, WS3, 4-8 and 9-13-year-olds].

Regarding the exhibition, it was not possible to see how the students and staff who did not take part in the Living Labs reacted to the exhibition as they were only allowed to visit it after the ZSI staff had left due to time restrictions [Austria, ZSI, WS3, 4-8 and 9-13-year-olds].

4.3 Conclusions

4.3.1 Process reflection

4.3.1.1 Strengths

The topic of bioeconomy raised the students' interest across all Living Labs, resulting in an overall high level of engagement of all the three targeted age groups in all three countries. The agile, heterogeneous interactive and practical methodologies applied in the workshops together with the moderation and facilitation style of the involved GenB project partners was a key strength of the Living Lab process [Austria, ZSI, WS1, 14-19-year-olds; Italy, APRE, WS1-3, 4-8 & 9-13-year-olds, FVA, WS1-3, 14-19-year-olds; Slovakia, PEDAL, WS1-3, 4-8 & 9-13-year-olds].

Importantly, at the beginning of the Living Lab process, contact and a relationship needed to be established between the facilitators of the Living Lab and the students involved. This was key to establish an atmosphere of fruitful collaboration, and respect [Austria, ZSI, WS2, 4-8 & 9-13-year-olds] and even allowed for having some of the Living Lab workshops successfully facilitated online [Italy, FVA, WS2, 14-19-year-olds].

From a facilitation point of view, repetition both of methodologies by facilitators as well as of concepts and contents for and with the students was reported a strength and important feature across different Living Labs. Throughout all labs, students were always allowed to raise questions at any time. Moderating the group dynamics and forming appropriate groups was also considered key. Some partners asked the involved teachers to organise groups. In the Living Lab of the oldest age group in Slovakia, groups were formed on the basis of different expertise held among the students. This helped the process and also led to informal peer learning amongst the student groups [Slovakia, PEDAL, WS1-3, 14-19-year-olds].

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The timing of the workshops was mostly reported allowing for just enough time to delve into the aimed for activities, while also allowing for breaks. Having had a dedicated timekeeper throughout the workshop significantly eased managing tight timeslots of changing groups [Austria, ZSI, WS2, 4-8 & 9-13-year-olds].

For the Slovak Living Labs, the collaboration with the Leisure Centre Gesayova was reported being a major strength for both, engaging students and schools in the process in the first place and in facilitating and "implementing innovative formats and topics in schools" [Slovakia, PEDAL, WS1, 4-8, 9-13 & 14-19-year-olds].

Teachers were reported being a major support across several Living Labs. Their involvement and engagement were described as key for getting access to the school and the students in the first place, as they often acted as intermediary between the project partners and the engaged school administration and – ultimately – students [Austria, ZSI, WS1, 4-8 & 9-13-year-olds; Italy, FVA, WS 1-3, 14-19-year-olds]. Teachers were not only a resource for the set up, but also for running the Living Lab, supporting in the facilitation by e.g., moderating group dynamics, adding supportive additional explanations of concepts and linking the newly heard knowledge with already familiar concepts [Austria, ZSI, WS1, 4-8 & 9-13-year-olds; Italy, FVA, WS 1-3, 14-19-year-olds]. Also, further endeavours to link the content of the bioeconomy Living Lab to the educational curriculum depends on the teachers' engagement [Slovakia, PEDAL, WS1-3, 9-13-year-olds].

4.3.1.2 Challenges

The role of the teachers, however, could also be challenging e.g., when they were not too responsive intermediaries [Austria, ZSI, WS1, 4-8 & 9-13-year-olds], or not too supportive during the workshop settings [Italy, APRE, WS1-3, 4-8 & 9-13-year-olds]. Also, their unavailability on the basis of health problems posed challenges for two of the Slovak Living Labs [Slovakia, PEDAL, WS3, 4-8 & 9-13-year-olds].

Content wise, the lack of a prior understanding of climate and the environment was reported being a major challenge for the Living Labs on bioeconomy [Slovakia, PEDAL, WS1-3, 4-8-year-olds]. This was also mirrored by the national educational curriculum lacking related subjects and contents and made it more difficult to build on existing knowledge or link with already familiar concepts [Slovakia, PEDAL, WS1-3, 4-8-year-olds].

In the beginning, the lacking relationship of trust amongst the facilitators and the young Living Lab participants could cause some difficulties in starting the Living Lab process [Austria, ZSI, WS1, 4-8 & 9-13-year-olds].

Additionally, students did not always feel ready to take action from the very beginning. Rather, one partner reported being faced with students feeling powerless to change anything [Slovakia, PEDAL; WS1, 4-8 & 9-13-year-olds]. "They needed encouragement and inspiration to realise

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their potential in contributing to positive environmental solutions" [Slovakia, PEDAL, WS1-3, 4-8-year-olds].

The students could work autonomously on their projects, which was, however, also reported being challenging, causing students in parts to an uncertainty about their roles and tasks [Slovakia, PEDAL, WS1-3, 9-13-year-olds].

Overall, group dynamics amongst the involved students were reported partly challenging across most Living Labs. In particular, the fluctuation of participants between workshops, missing engaged students in the next workshop or integrating newcomers at a later stage in the Living Lab process were reported challenging. Also, keeping the attention span of all students, having them listen to each other was reported as challenging [Italy, APRE, WS1-3, 4-8-year-olds].

Most Living Labs failed at directly including parents in the workshops. Through indirect activities, however, parents have been somewhat engaged across most Living Labs.

Another challenge two partners (ZSI for the younger two age groups and FVA for the oldest age group) faced were mastering the physical distance to the engaged schools, requiring a lot of time to getting there in the first place, even limiting the possibility of face-to-face workshops in one case [Italy, FVA, WS2&3, 14-19-year-olds], as the school was more than 3 hours of driving away from the partner's organisation.

The timing was also reported being challenging across all labs [Austria, Italy and Slovakia, all WS, all age groups]. Short time slots in parts slightly inhibited the students' autonomy [Austria, ZSI, WS2, 9-13-year-olds], or led to not being able to go through the whole agenda for the workshop [Austria, ZSI, WS3, 4-8 & 9-13-year-olds; Italy, APRE, WS1-3, 4-8-year-olds]. Strict timing was also reported challenging for facilitating the hands-on activities happening in station-based small-group settings [Austria, ZSI, WS2, 4-8 & 9-13-year-olds]. For facilitating the Living Lab successfully, also the larger school-schedule needed to be considered and posed most involved GenB consortium partners with challenges. In the case of FVA a mismatch of the project timeline and the school's schedule even led to one online workshop with only teachers participating, reporting on the students' activities. FVA therefore organised additional online meetings with the students and teachers to close the Living Lab activities in the fall of 2023. In addition, several online meetings with the teachers have been organised by FVA to follow closely the activities that were done autonomously by the students and teachers between the Living Lab workshops. Also, the timing of the GenB project was not completely aligned with the individual timelines of the Living Labs, with e.g., the call for GenB ambassadors not yet being launched at the final workshop in Austria [Austria, ZSI, WS3, 14-19-year-olds].

4.3.1.3 Feedback from participants

ZSI surveyed participants of all its Living Labs in Austria to indicate their experience of the Living Lab processes.

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For the younger age groups of 4-8 and 9-13-year-olds, the specific experience of the hands-on sessions (Workshop 2), as well as the overall Living Lab process was evaluated (Workshop 3). For collecting answers, students were asked to put a sticker in the column corresponding to their experience.

The majority of the engaged students (81%) liked the hands-on experiments, with about three quarters (76%) liking to paint with natural colours, about two thirds (68%) enjoying the creation of seed balls, and the same share (68.5%) liking also the bioeconomy-based memory game. There is no clear variance with age, but some variance with the involved groups, as some Living Labs involved two.

At a general level, about three quarters (76.6%) of the Living Labs participants liked the Living Labs process. 21,2% were neutral, while 3,5% did not take part in the evaluation. None of the participants indicated not liking the process, i.e., no sticker was placed in any of the columns with the sad smiley face. The feedback again varied more with individual classes than with age group and might be related to the teacher's involved support/encouragement or lack thereof [Austria, ZSI, WS3, 4-8 & 9-13-year-olds].

Also, the experience of the oldest involved age-group (14-19-year-olds) was surveyed in Austria (Workshop 3). The feedback was overall positive, indicating that the students were inspired by the ideas of others, liked the methods, group discussions and also the possibility to use their science lessons for the Living Lab process. Particularly, students liked the experiments, the small in-between games (e.g., icebreakers), but also the projects, working independently and also being able to collaborate. Some negative feedback was also collected, with some participants indicating that they found the Living Lab process stressful, sometimes boring or too much or just having no interest in bioeconomy. With regard to individual follow ups on the topic of bioeconomy, many of the responses demonstrate a clear awareness of the connection between individual actions and broader environmental sustainability. The collected answers range from waste reduction to sustainable consumption choices, reflecting a positive commitment to incorporating bioeconomy principles into daily life.

In this age group, also the knowledge about bioeconomy was surveyed, with regards to their level of knowledge on the topic before the Living Labs process and at the end. On a scale of 0-10, 62.5% indicated having little knowledge (a rating of 4 on the scale) in the beginning. At the end of the Living Lab process, 81.3% rated their knowledge being at 7 or above, clearly indicating a knowledge gain. Also, 44% indicated their attitude towards bioeconomy has changed. The follow up question, however, did not properly work out due to technical difficulties, leaving the direction of attitude change somewhat open [Austria, ZSI, WS3, 14-19-year-olds]

The other consortium partners did not engage their participants in specific formal surveys, while collecting direct feedback from the involved students in the Living Labs in Italy and Slovakia through informal interviews. All of them report students being highly interested and engaged, proactive and enthusiastic about the process. Additionally, teachers in Italy evaluated this

experience as highly relevant for their school activities and defined the results as a key format to engage effectively students in the topics. In Slovakia, the teachers were interested to continue in similar activities and proposed to link the activities with existing curriculum. In Austria, some teachers in the Living Labs with the younger age groups plan to continue with the topic in the coming year and are also interested in future GenB activities, just like the teachers in the high school that implemented the Living Lab in Austria.

4.3.2 Lessons for Improvement

4.3.2.1 Austria

4.3.2.1.1 Living Labs with 4-8-year-olds and 9-13-year-olds

4.3.2.1.1.1 Workshop 1

The first workshops of the Living Labs with 4-8-year-olds and 9-13-year-olds in Austria involved introducing the topic of bioeconomy to the children with the help of the "What's bioeconomy?" book for kids, exhibition of selected bio-based products and concretising the learned concepts through drawing.

1. **Use of technology for student engagement**: To maximise student attention in the first part of the workshop, consider showing the "What's bioeconomy?" book on a screen before providing physical copies, if possible. This can help maintain focus and engagement [Austria, ZSI, WS1, 4-8 & 9-13].

2. **Focus on key information – sometimes less is more**: Considering the complexity of the topic of bioeconomy and the complexities associated with explaining the concept to young people, it might be helpful especially when using the "What's bioeconomy?" to convey the topic, to focus on fewer sub-topics or examples to avoid overwhelming the participants [Austria, ZSI, WS1, 4-8 & 9-13].

3. **Allocate sufficient time**: Providing more time for activities, such as showcasing bioeconomy materials and drawing ideas, can enhance the quality of the workshop [Austria, ZSI, WS1, 4-8 & 9-13].

4. **Clarity in instructions**: Moderators should strike a balance between providing clear and concise instructions for assignments and avoiding overwhelming children with too many options. Uncertainty in the assignment can arise when moderators overcompensate by offering excessive choices, leading to confusion among the children. It's essential to have confidence in the children's ability to understand and follow assignments when they are presented in a straightforward and manageable manner. Clarity in instructions promotes engagement and a more effective learning experience [Austria, ZSI, WS1, 4-8 & 9-13].

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4.3.2.1.1.2 Workshop *2*

The second workshop of the Living Labs with 4-8-year-olds and 9-13-year-olds in Austria involved a station-based workshop to enhance the participants' knowledge on the topic of the bioeconomy and also to check-up on the status of their ideation process outside of the workshops. Hence four stations were organised, and they were organised in a way that each participant would be able to experience each. They included: Discussion of project ideas, painting with colours from spices and plants, creating seed balls and playing the bioeconomy memory game from Transition2Bio.

1. **Managing participant engagement in specific environments**: The physical environment impacts participant engagement; consider this when planning sessions. As this session on discussion of project ideas took place in the "bioeconomy room" in the context of the second workshop, when the participants got in, they could already see the set-up hence they were quite excited to "get their hands dirty". Therefore, it was somewhat challenging keeping the participants' attention in the introduction and the discussion of the project ideas session which was held right at the beginning [Austria, 4-8 and 9-13, WS2].

2. **Flexibility in timing**: Recognise the importance of flexibility in workshop timing. The strict schedule based on the available time, number of participants and stations can make stations and activities demanding. Allowing more time for each segment would lead to a smoother and less stressful experience for both the moderators and participants [Austria, ZSI, WS2, 4-8 & 9-13].

3. **Designate a timekeeper**: Designating a moderator as the timekeeper and overseer is crucial to maintaining the flow and timing of activities. This ensures that each station is adequately managed, and participants stay on track [Austria, ZSI, WS2, 4-8 & 9-13].

4. **Enhanced direct teacher communication**: While the role of the intermediary teacher is crucial for overall organisation, it is equally important to maintain direct communication with class teachers. Relying solely on communication with the intermediary may lead to gaps in information and coordination e.g., in the case of the second workshop, collaborating with teachers to prepare both them and their students for the idea presentation can lead to a more coordinated and successful workshop. A concrete example refers to the fact that at the second workshop with 9-13-year-olds in Austria, the project idea station could have been left out altogether or restructured as the pupils were already very advance in the exploration phase [Austria, ZSI, WS2, 4-8 & 9-13].

5. **Balancing idea development and time constraint**: Incomplete idea preparation can lead to frustration when time limits prevent immediate decisions on project ideas. For one of the classes of the younger age group, 4-8, their ideas were still at a very early developmental stage or rather it seemed that the brainstorming had not taken place fully in the period before the workshop, hence although many seemed hesitant at the beginning, they were

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still able to come up with a good number of ideas. However, due to the limited time, they it was not possible to decide then and there, which ideas they would develop further, which seemed frustrating for some of the children who had prepared or shared their ideas [Austria, ZSI, WS2, 4-8].

6. **Enhanced support of teachers in the co-creation phase**: Some teachers may require better preparation to effectively support students during co-creation phases. For some of the classes that had not completed the co-creation phase, this station seemed a little overwhelming, especially for the teachers, as it seemed that they were not well prepared to share their ideas [Austria, ZSI, WS2, 4-8 & 9-13].

4.3.2.1.1.3 Workshop 3

The third workshop of the Living Labs with 4-8-year-olds and 9-13-year-olds in Austria was aimed for the presentation of the participants' projects and products to a wider audience as well as the reflection and evaluation of the Living Labs process altogether.

1. **Structured feedback collection from teachers**: Feedback from the teachers is essential in such a process. To gather feedback from teachers effectively, it is crucial to plan for structured feedback sessions during the process, such as short focus groups. This ensures timely and valuable input from teachers. Expecting the feedback by email as done in Austria proved to be quite challenging especially considering that the last workshop took place shortly before the start of the summer vacations [Austria, ZSI, WS2, 4-8 & 9-13].

2. **Facilitating a reflection session**: In such a process it is important to provide participants, including students and teachers, with an opportunity for reflection. Consider organising an additional workshop or reflection session to better understand participants' experiences, preferences, and their plans for future projects and products. This reflection process can aid in refining end results and insights into participants' needs and adjustments [Austria, ZSI, WS2, 4-8 & 9-13].

3. **Consider external events in the planning**: Considering external events should encompass an awareness that heavy reliance on communication with the intermediary teacher may result in unawareness of potential conflicting commitments. This approach places a significant workload on one person, considering their existing work commitments. Had ZSI staff been aware of the summer event, proactive measures could have been taken to schedule the final workshops within this framework. This would have ensured that participants' projects reached a broader audience, including their families [Austria, ZSI, WS2, 4-8 & 9-13].

4. **Validate workshop timing with participants**: Feedback from participants and teachers, resulting in a delay in the workshop, can serve as validation for the suggested timing in the guideline. It's essential to align workshop schedules with the participants' needs and

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preferences as done with regards to the last workshops with 4-8-year-olds and 9-13-year-olds in Austria where the workshop was pushed by two weeks. The original timing suggested by the intermediary teacher considering the school calendar was two weeks earlier than the one suggested in the GenB guideline for Living Labs [Austria, ZSI, WS2, 4-8 & 9-13].

5. **Provide tangible information for offers**: When introducing opportunities like call for GenB ambassadors, ensure that participants receive tangible informational materials during the workshop. This facilitates discussions with parents and enhances participation clarity. At the time of the last workshop, the call was not officially out and hence this information was only explained by the moderators and further information was sent to the intermediary teacher by email. This might explain why the call did not have very positive results in Austria. This was the case also with the final workshop with the 14-19-year-olds in Austria [Austria, ZSI, WS3, all age groups].

4.3.2.1.2 Living Labs with 14-19-year-olds

4.3.2.1.2.1 Workshop 1

This workshop had the same aim as the first workshop with the younger age groups: Introduction to concept of bioeconomy through a tailored presentation and exhibition of selected bio-based products as well as an experiment to make bioplastic from orange peels, a recipe from the Transition2Bio project.

1. **Enhancing learning through curriculum alignment**: Introducing a topic in connection to what students are currently learning enhances comprehension and engagement. For example, in the first workshop with 14-19-year-olds in Austria, the concept of bioeconomy was introduced in relation to food and food waste, aligning with their ongoing curriculum on food. This approach facilitates a deeper understanding of the subject matter and promotes active participation among students. [Austria, ZSI, WS1, 14-19].

2. **Pre-test experiments**: It is crucial to pre-test any experiments before conducting them in a workshop. This practice helps to avoid difficulties or uncertainties stemming from unclear instructions and ensures better preparation for a successful lesson [Austria, ZSI, WS1, 14-19].

3. **Internet reliability**: Never solely rely on a stable internet connection, particularly in school environments. To mitigate the risk of connectivity issues, consider downloading materials in advance, setting up a hotspot, or preparing offline activities as viable alternatives. This safeguards the smooth progression of the workshop, even in the absence of a dependable internet connection [Austria, ZSI, WS1, 14-19].

4.3.2.1.2.2 Workshop 2

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The second workshop with 14-19-year-olds in Austria was dedicated to the second part exploration phase of the Living Labs process – i.e., prototyping/bringing the ideas to life as the co-creation phase and the first part of the exploration phase had been completed in the time between the first two workshops.

1. **Effective idea generation timeframe**: Allowing participants the timeframe between the first and second workshops to brainstorm ideas proved to be a successful strategy. During this period, all groups dedicated thoughtful consideration to their projects, arriving at the second workshop with well-defined ideas in line with the objectives outlined in the GenB guideline for the interim period between face-to-face sessions with the project team. The extended time window in this phase, compared to a single workshop session, likely contributed to the generation of a greater number of ideas that genuinely resonated with the participants and were feasible for implementation [Austria, ZSI, WS2, 14-19].

2. **Pilot idea elaboration session**: Prior to the development of pilot ideas, organising a brief session to elaborate on key dimensions of a pilot action can be highly beneficial. This approach aids in concretising all ideas and rendering them more achievable, offering a structured framework for participants especially considering the limited time available for the process in general [Austria, ZSI, WS2, 14-19].

3. **Enhancing pilot ideas with external guidance**: Possibly, the group working session could have used more external guidance to make some of the pilot ideas even more concrete [Austria, ZSI, WS2, 14-19].

4.3.2.1.2.3 Workshop 3

Like at the third workshop with the younger age groups in Austria, this workshop for 14-19-year-olds was aimed at showcasing the developed projects and together as group reflecting on the whole Living Lab process as well as evaluating specific aspects of it.

1. **Improved preparation**: During the third workshop, it became evident that some groups were unprepared for their project presentations. This underscores the importance of providing detailed instructions, guidelines, and support, as well as offering clarity to avoid such situations in future workshops [Austria, ZSI, WS3, 14-19].

2. **Room setup**: Setting up the room in a "classroom style," with desks and chairs facing the front, proved to be conducive for presentations. This setup facilitated the engagement of participants and the effective showcasing of project outcomes [Austria, ZSI, WS3, 14-19].

3. **Technical facilities and equipment**: Ensuring that the workshop venue is equipped with the necessary technical resources, such as projectors and sound systems, is vital for successful presentations. These tools simplify the process of sharing visual content like videos and presentation slides [Austria, ZSI, WS3, 14-19].

4. **Support for varied presentation styles**: Depending on the nature of the projects, some groups may require specific tools or equipment, like computers and beamers. Offering a range of resources that accommodate diverse presentation styles is essential for a seamless and effective workshop process [Austria, ZSI, WS3, 14-19].

5. **Leveraging Living Lab participants as testers and target audiences**: In cases where projects within the Living Lab are developed by different groups, the absence of a wider audience during presentations may not be as critical as it initially seems. This is because the other participants not directly involved in a specific project can effectively serve as both testers and representatives of the target audience. Their valuable feedback and input can significantly contribute to the experimentation phase of the Living Lab, aiding project refinement and enhancing overall project quality [Austria, ZSI, WS3, 14-19].

6. **Incorporation of immediate feedback for project reflection and improvement**: Integrating structured reflection and feedback sessions immediately following each project presentation during the third workshop was an effective practice. This approach provided a platform for open discussions, constructive critique, and idea refinement, contributing to project improvement [Austria, ZSI, WS3, 14-19].

7. **Enhancing feedback quality**: The implementation of a token system on Mentimeter could have been particularly valuable for assessing participants' knowledge of bioeconomy before and after the workshops. This system would ensure that their individual progress and understanding could be tracked while maintaining anonymity, thereby enhancing the quality of feedback [Austria, ZSI, WS3, 14-19].

8. **Enhanced technical testing and reliability**: When using Mentimeter for surveys, it is crucial to conduct thorough technical testing to prevent mishaps. For instance, during the implementation, some participants received questions they shouldn't have, indicating a potential failure in the survey process. Although the survey was tested, performing multiple rounds of testing could have been beneficial to ensure reliability and the accurate capture of participant responses. This additional testing could help avoid any issues, such as the one encountered during the workshop [Austria, ZSI, WS3, 14-19].

9. **Timely data collection**: At the end of the semester, only the documentation, namely, the videos from one project had been received, but other project-related materials, such as letters to the head of the supermarket and the presentation for the group on the education of bioeconomy, were missing. To avoid such gaps, it's essential to collect all project information promptly after each workshop, setting clear deadlines to ensure nothing falls through [Austria, ZSI, WS3, 14-19].

10. **Enhanced engagement and communication**: The workshop participants were encouraged to follow up on opportunities like the call for ambassadors. However, the approach could have been more effective by providing tangible materials, such as handouts, which would

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serve as reminders and help participants stay engaged in related initiatives and opportunities beyond the workshop [Austria, ZSI, WS3, 14-19].

11. **Group dynamics and clique awareness**: During the course of the workshops, it became evident that cliques had naturally formed among the participants. This was noticeable from where students chose to sit, who they were comfortable conversing and joking with, and who they collaborated with. These cliques were especially apparent during the discussion section of the workshop, where certain groups would engage more with each other. Additionally, during activities like the "brainwalk"/ “flipchartwalk”, one particular group seemed particularly interested in each other's opinions and would collaborate openly, making comments and suggestions together. Despite the presence of cliques, they didn't disrupt the workshop. However, these dynamics may impact how project groups are formed. It's important to consider the influence of these cliques when arranging project groups or assigning tasks to ensure effective collaboration [Austria, ZSI, all workshops, 14-19].

4.3.2.2 Italy

4.3.2.2.1 Living Labs with 4-8-year-olds and 9-13-year-olds

1. **Extended time for the Living Labs process**: More time is required to conduct Living Labs effectively, especially to make them student-centred. The current number of appointments (3/4) is insufficient. Having additional time can enhance the quality of the activities [Italy, APRE, 4-8 & 9-13].

2. **Knowledge and awareness building on the bioeconomy**: It's essential to dedicate sufficient time to raise awareness about and consolidate knowledge of the bioeconomy, preferably through engaging and fun methods such as toolkits, materials, experiments, and videos before or at the beginning of the Living Labs process. This helps students grasp the subject more effectively [Italy, APRE, 4-8 & 9-13].

3. **Use of dynamic, interactive methods in teaching children the concept of bioeconomy**: The use of dynamic, interactive, group work, and hands-on methodologies significantly increases students' engagement and their understanding of the topic. These approaches are more effective in conveying complex concepts such as bioeconomy [Italy, APRE, 4-8 & 9-13].

4. **Skilled facilitation and workshop support**: High-skilled facilitators and staff support are essential for the success of Living Labs. They help maintain alignment with teachers, keep students engaged, foster dialogue, and fine-tune the outcomes even beyond the workshops [Italy, APRE, 4-8 & 9-13].

5. **Tailoring activities for children in Living Labs on bioeconomy**: When organising educational activities, such as the Living Labs on bioeconomy for children, it's crucial to

consider different methods for involving students based on their age group, personality, background, needs, and tastes. Tailoring different activities and materials to match students' unique characteristics is particularly essential in this context to ensure their engagement and effective learning experiences [Italy, APRE, 4-8 & 9-13].

6. **User-centred approach**: Embrace a user-centred approach, actively listening to and incorporating the inputs, needs, and preferences of students when designing educational products. Avoid imposing top-down ideas, even though this may slow down the process, as it ensures the final product aligns better with students' expectations and learning styles and increases ownership of the final products [Italy, APRE, 4-8 & 9-13].

7. **Integrating bioeconomy Living Labs into the school curriculum for more teacher engagement**: To foster active teacher participation in the Living Labs on bioeconomy, consider integrating the activity into the school's curriculum at the start of the school year. This collaborative approach encourages teachers to engage more effectively in all phases of the Living Labs, leading to a more successful educational experience [Italy, APRE, 4-8 & 9-13].

8. **Actively involving parents**: For active parental involvement in the Living Labs, specific activities should be planned in a way that considers the time availability of parents. This helps to ensure their participation [Italy, APRE, 4-8 & 9-13].

9. **Diverse locations for Living Labs with children outside the school**: While schools provide a conducive environment for maintaining concentration during classroom hours, it's essential to utilise various spaces for conducting Living Labs. In addition to classrooms, incorporating laboratories and external areas for dissemination of activities and experiments is ideal. This approach enhances engagement and promotes the participation of a more diverse stakeholder group, resulting in a richer and more inclusive educational experience [Italy, APRE, 4-8 & 9-13].

10. **Budget considerations**: Adequate budget allocation is a crucial aspect of conducting successful Living Labs. Proper funding should be considered to cover the costs of materials required for the labs and the prototyping of educational materials [Italy, APRE, 4-8 & 9-13].

4.3.2.2.2 Living Labs with 14-19-year-olds

1. **Designing innovative formats to engage young people in the** bioeconomy: the main outcome of this Living Lab was the co-creation and co-design of a solid, well-structured, effective and replicable format to reach, inspire, motivate and raise interest of high school students in those topics. The design of an escape game is a very challenging task, both for the complexity of the format and the innovative dimension of injecting educational contents on environmental issues in a playful experience. The “Escape4Future” game’s innovation derives from the fact that it was designed by students and teachers with the

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support of experienced communicators. This cross-fertilisation led to the creation of a unique asset with great exploitation potential from GenB itself and other projects and initiatives.

2. **Integrate the Living Labs on bioeconomy in the PCTO programme**: Engaging high school students and teachers in Living Labs requires careful consideration, especially in Italy, where they are already occupied with various activities, including the Pathways for Transversal Skills and Orientation (PCTO) that is a mandatory task during the last three years of high school. These students participate in PCTO to explore experiences in institutions or private companies to gain a better understanding of their career aspirations and talents. Therefore, adding additional activities like GenB Living Labs can be challenging. A proactive solution is to establish early collaboration and close alignment with high schools to integrate GenB Living Labs into the existing PCTO programs. As PCTO includes orientation activities and skill development in areas such as social, learning, citizenship, business, and cultural skills, GenB Living Labs can seamlessly fit into this framework. This approach ensures high school students can actively participate in the Living Labs without overburdening their schedules. [Italy, FVA, 14-19]

3. **Tailoring escape game for diverse audiences**: The escape game in the implementation workshops proved to be a very effective format to involve youngsters and adults at the same time. Nevertheless, the format developed in the Living Labs mostly targets participants above 14 years old, because of the complexity of some enigmas to be solved, quizzes and experiments. To also engage younger participants (during Fermhamente festival) the game was implemented in a more simplified version. In this context, the game was facilitated a lot by the high school students of the Living Labs, being more similar to an experiential didactical game.

4. **Age homogeneity**: The two versions of the escape game (the one for above 14 years old players and the one for kids) are effective if the participants are homogeneous in terms of age. This is why is very important to organise different age groups in order to implement the two versions separately, adapting the format according to the target age. The game played in mixed groups risks being too easy for the teenagers and too complex for the little ones.

5. **10-12 participants are an optimal group size for immersive experiences**: It is suggested to organise groups of maximum 10-12 participants to allow an immersive experience for everybody.

6. **Enhance replicability through adapting complex experiments**: The escape game has proven to be very replicable in all its parts and in different contexts. Nevertheless, there is the need to simplify one experiment that was proposed by the Living Labs students, since it requires chemistry knowledge and specific reagents to start the antioxidant reaction. FVA

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is studying a way to reach the same result to make this experiment easier and replicable by other multipliers (e.g., through videos or interactive ICT tools).

4.3.2.3 Slovakia

4.3.2.3.1 Living Labs with 4-8-year-olds and 9-13-year-olds

1. **Stronger connection with school subjects**: Collaborating with teachers from other subjects like biology, geography, and art could have provided opportunities for interdisciplinary learning. A stronger connection with other subjects taught in the school curriculum would have enhanced students' understanding and engagement in the Living Lab workshops. Future activities should be planned together with the teachers at the beginning of the school year, ensuring a seamless integration of Living Lab content with the regular curriculum. This collaboration can lead to a more holistic learning experience and enrich the students' understanding of the bioeconomy in various contexts [Slovakia, PEDAL, 4-8 & 9-13].

2. **Timely organisation of activities**: Feedback from teachers emphasised the importance of scheduling Living Lab activities earlier in the school year. Teachers suggested that organising such activities at the end of the school year, when their schedules become increasingly busy with other commitments, may not be ideal. The lesson learned is that early planning and execution of these activities can lead to better teacher participation and ensure that students receive the full benefit of the Living Lab experience without the constraints of a packed end-of-year schedule [Slovakia, PEDAL, 4-8 & 9-13].

3. **Utilising participant feedback**: The feedback sessions conducted with both teachers and students have proven to be invaluable. The positive response from both parties underscores the significance of initiatives that aim to instil environmental awareness and empower young individuals to actively contribute to building a sustainable future. The lesson learned is that ongoing feedback collection and analysis is essential for refining and enhancing future Living Lab workshops, ensuring they remain effective and impactful [Slovakia, PEDAL, 4-8 & 9-13].

4. **Enhancing teachers' understanding of the bioeconomy**: To improve future Living Lab workshops, it is essential to enhance teachers' knowledge of the bioeconomy and how to integrate it into their subjects. Capacity-building programs can be introduced to boost teachers' understanding and proficiency in bioeconomy-related topics [Slovakia, PEDAL, 4-8 & 9-13].

5. **Fostering collaboration with schools**: Building trust with schools and teachers is a crucial factor in effectively involving them in the Living Lab activities. Establishing and nurturing strong relationships with educational institutions is key to ensuring their active participation and support. [Slovakia, PEDAL, 4-8 & 9-13].

6. **Workshop implementation**: To enhance students' understanding and engagement, consider organising several shorter sessions rather than a single lengthy one. These shorter sessions can serve to reinforce knowledge and enable students to connect the Living Lab experience with the topics covered by their school curriculum. By spacing out the learning opportunities, students have more time to digest the information, ask questions, and apply their knowledge effectively in the final projects [Slovakia, PEDAL, 4-8 & 9-13].

7. **Adapting workshop methodology for student needs**: The workshop process demonstrated the importance of adjusting the methodologies to suit the students' prior knowledge and experience. By aligning with the approaches applied by the teacher in regular classes, the workshops were better tailored to students' needs, ensuring a seamless transition into the bioeconomy topics [Slovakia, PEDAL, 4-8 & 9-13].

4.3.2.3.2 Living Labs with 14-19-year-olds

1. **Allocate sufficient time for Living Labs**: The pilot program highlighted the need for more time, as it was apparent that a longer duration could have better accommodated the diverse activities and interactions involved in the Living Lab. Future Living Labs should consider an extended timeline to ensure comprehensive exploration and engagement [Slovakia, PEDAL, 14-19].

2. **Enhance parental involvement**: Ensuring parents are actively engaged can add value and support to the students' experiences. Future iterations should explore ways to connect with parents and encourage their participation in these activities [Slovakia, PEDAL, 14-19].

3. **Adapt and improve**: Despite the challenges faced, the Living Lab pilot was a valuable learning experience. It demonstrated the significance of being adaptable and open to improvements. In planning for future Living Labs, it is crucial to consider the lessons learned, address challenges, and continuously enhance the format to achieve better results [Slovakia, PEDAL, 14-19].

4. **Flexible project selection**: Offering a range of project options at the beginning can help students find projects that truly excite them. For instance, during future Living Labs, individual discussions with students can be conducted to identify their interests and passions, allowing project options to be tailored accordingly [Slovakia, PEDAL, 14-19].

5. **Strong group leadership**: Identifying and encouraging strong group leaders is crucial for the success of the Living Lab. Early observation of group dynamics and providing opportunities for potential leaders to emerge can be essential [Slovakia, PEDAL, 14-19].

6. **Involvement of potential users**: Engaging potential users, such as students from lower grades, allows for valuable feedback and insights. Regular feedback sessions with potential

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users during the development process can ensure the project aligns with their preferences and needs. [Slovakia, PEDAL, 14-19].

7. **Timing**: The timing of the Living Lab should consider school schedules, internships, and other commitments of students and teachers. Coordination with the school calendar, ensuring sufficient time for all stages of the project, should be prioritised during future Living Labs [Slovakia, PEDAL, 14-19].

8. **Active facilitations and encouragement**: Active facilitation and continuous encouragement play a vital role in sustaining motivation and enthusiasm among participants. Maintaining regular communication with students, providing support, and celebrating milestones achieved throughout the Living Lab are practices that should be continued in future iterations [Slovakia, PEDAL, 14-19].

9. **Collaboration between teachers and out-of-school centres for children like the Gessayova leisure centre**: The collaboration between teachers and the leisure centre was beneficial in supporting the Living Lab's implementation and providing additional resources. Strengthening and expanding collaborations with educational institutions and such centres should be a key focus for future Living Labs to enhance their impact and reach [Slovakia, PEDAL, 14-19].

10. **Introduction to broader concepts**: Addressing basic environmental concepts before diving into specific topics like bioeconomy is essential for creating a solid knowledge base. Future Living Labs should continue conducting introductory sessions to provide a comprehensive understanding of sustainability, climate change, and related topics [Slovakia, PEDAL, 14-19].

11. **Physical setting of Living Lab**: The physical setting of the Living Lab in the school environment facilitated interactions and group dynamics. Future Living Labs should continue organising these activities in classrooms or school spaces to create a conducive atmosphere for collaborative activities [Slovakia, PEDAL, 14-19].

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5. Part three: Common Ground Camp

5.1 Preliminary Planning and Design

5.1.1 Introduction

The Common Ground Camp was a key event in the GenB project, which intends to raise the Generation Bioeconomy (GenB), children and young adults, aware, sensitive and interested in environmental issues, sustainability and circularity. This report offers a concise overview of the Common Ground Camp and its objectives, while also providing insights into the preliminary planning and design phase of this participatory event. Additionally, the report outlines the meticulous process employed for selecting educators to participate in the co-creation workshops and the methodology used for inviting speakers. Furthermore, it provides context for the talks delivered by the invited speakers.

The EU-funded GenB project seeks to collaboratively develop innovative approaches to teaching, learning, and raising awareness about the bioeconomy. The Common Ground Camp was a key component of this project, serving as an essential platform for achieving the respective project objectives and goals (SO1: Co-creating innovative approaches, formats, materials and tools, through the cooperation between children, young adults, parents, teachers and other formal and non-formal education professionals, to provide educational and informational toolkits on bioeconomy in general and bio-based sectors). This report aims to shed light on the event's significance and provide an understanding of its purpose.

The report begins by presenting a brief overview of the Common Ground Camp, emphasising its objectives and core focus. In addition to discussing the event itself, this report also delves into the preliminary planning and design phase. It highlights the careful process undertaken to select educators for the co-creation workshops, ensuring their expertise, qualifications, and alignment with the objectives of the Common Ground Camp. Furthermore, the report outlines the methodology employed to invite speakers who would deliver keynote talks at the event.

By providing this comprehensive context and outlining the educator selection process and speaker invitation methodology, the report offers a deeper understanding of the planning and design phase of the Common Ground Camp. It sets the foundation for subsequent sections that will delve into the event's agenda, highlighting the keynote talks, presentation of inspirational practices, and the group work and co-creation activities that took place during the workshop.

5.1.2 Event Overview

Fostering Collaborative Bioeconomy Education for Sustainable Future

The Common Ground Camp, organised by the Hellenic Society for the Protection of Nature as part of the EU-funded GenB project, was a two-day workshop held on February 21st (hybrid) and 22nd (physical only), 2023, at The Stanley Hotel in Athens, Greece. The event aimed to promote bioeconomy practices in formal and non-formal education settings, with a focus on nurturing a future generation that embraces sustainability and bioeconomy. The workshop

facilitated information exchange, showcased inspirational examples, and encouraged the co-creation of innovative teaching methods and approaches.

The event set out to achieve primary objectives that revolved around advancing bioeconomy practices in education, both within formal and non-formal settings. It sought to cultivate collaboration among participants, encourage the sharing of best practices, and stimulate the creation of innovative teaching methods. By bringing together educators, education policymakers, regional authorities, school administrators, teachers, museums, science communicators, youth organisations, community groups, and participants from other EU-funded projects/initiatives, the event aimed to create a diverse and inclusive platform for collaboration and knowledge sharing.

The workshop focused on the exchange of information, presentation of inspirational examples, and the co-creation of innovative methods and approaches. By leveraging the collective expertise and experiences of the participants, the event aimed to facilitate the sharing and adoption of best practices in bioeconomy education. It also aimed to obtain new insights and ideas on teaching, learning, and spreading the word about bioeconomy.

The Common Ground Camp was divided into two sections: keynote talks and presentation of inspirational practices during the first day, followed by group work and co-creation during the second day. This structure was carefully designed to ensure a balanced combination of knowledge dissemination and hands-on, interactive activities.

The keynote talks provided participants with essential background information on the bioeconomy, while showcasing successful educational tools and resources developed as part of EU-funded projects as well as other initiatives. These talks aimed to inspire participants and encourage them to explore new teaching methodologies and approaches.

The group work and co-creation activities aimed to foster active participation and collaboration among the attendees. Participants had the opportunity to work together in groups, share their expertise, exchange ideas, and develop innovative strategies and methods to incorporate bioeconomy concepts into their educational practices. This interactive and collaborative approach ensured that the event was not just a passive learning experience but an opportunity for attendees to actively contribute to the co-creation of educational resources and approaches.

Format

The Common Ground Camp embraced a hybrid format, combining both physical and virtual elements to accommodate the diverse needs and circumstances of the participants. This format was carefully designed to ensure inclusivity, flexibility, and optimal engagement for all speakers and attendees.

Virtual Participation: Recognising the importance of accessibility and overcoming geographical barriers, the event also incorporated virtual participation on February 21st, 2023. Through online platforms and technology-enabled solutions, participants and presenters were given the opportunity to join the Common Ground Camp remotely, connecting with the event and its activities from any location. Virtual participation allowed individuals who couldn't physically

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attend the event due to logistical constraints or other reasons to still engage and contribute to the discussions and co-creation process. This hybrid approach allowed also for seamless integration of online speakers who presented their projects remotely, enriching the event experience and expanding the range of expertise shared with the participants.

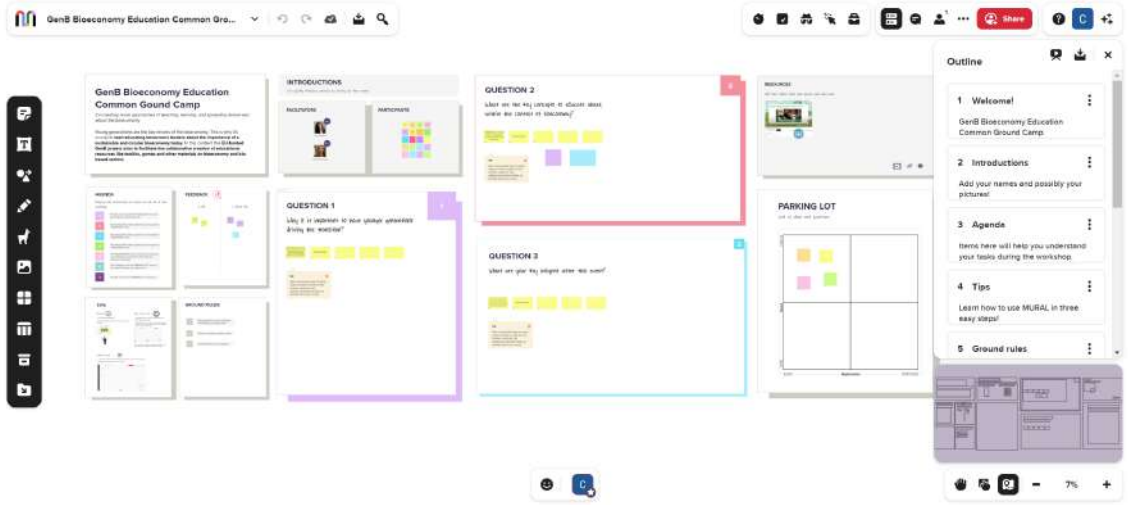

Figure 17: Online mural – co-creation process

In total, 50 individuals (41 participants and 9 speakers) actively participated online, making use of the virtual participation option. This significant number of online participants demonstrates the success of the virtual participation aspect, as it allowed individuals who were unable to physically attend the event due to logistical constraints or other reasons to still contribute to the discussions and co-creation process. Additionally, the inclusion of online speakers who presented their projects remotely not only enriched the event experience but also expanded the range of expertise shared with the participants, further enhancing the overall quality and diversity of the event.

Physical Attendance: Over the course of the two days, participation was possible in person, at The Stanley Hotel in Athens, Greece. This was especially important for the second day of the workshop, where the event was only accessible to participants at the physical location. This allowed participants to gather in person, fostering face-to-face interactions, networking opportunities, and a shared sense of community. The physical attendance option provided a unique environment for participants to engage in hands-on activities, workshops, and collaborative sessions. In total, the event saw the participation of 37 individuals, including both speakers and participants, on the 21st of February and a total of 34 individuals on the 22nd of February.

The hybrid format offered several advantages to the Common Ground Camp:

a. Flexibility: Participants had the option to choose the mode of participation that best suited their circumstances, ensuring maximum flexibility. They could decide to attend physically, benefitting from the immersive experience and direct interaction, or participate virtually, accommodating their personal or professional commitments.

b. Increased Accessibility: By incorporating a virtual component, the event expanded its reach, allowing participants from different locations, even outside Athens, to be part of the Common Ground Camp. This facilitated broader participation and ensured diverse perspectives and insights were brought to the discussions.
c. Technological Integration: The hybrid format leveraged technology to enhance the event experience. Virtual participants could access live streams of keynote talks, interactive workshops, and group activities. Additionally, online collaboration tools enabled virtual attendees to actively contribute to discussions, share ideas, and engage in co-creation exercises. Additionally, all the presentations were filmed to allow access of information to people who were otherwise not able to attend the event both in person or virtually.
d. Sustainability: The hybrid format aligned with the overarching theme of sustainability in the bioeconomy. By minimising travel requirements for virtual participants, the event reduced carbon emissions and ecological footprint, demonstrating a commitment to environmentally conscious practices.

Overall, the hybrid format of the Common Ground Camp blended physical and virtual elements, ensuring inclusivity, flexibility, and engagement. It provided participants with options for attending in person or remotely, fostering collaboration, knowledge sharing, and co-creation in an accessible and sustainable manner.

Venue

The selection of the venue and location for the Common Ground Camp was a thoughtful and strategic decision made to create an environment that would foster collaborative discussions and activities among the participants. Several factors were taken into consideration during this process:

a. Conducive Environment: The chosen venue, The Stanley Hotel in Athens, Greece, was carefully assessed to ensure that it provided an atmosphere conducive to productive and engaging interactions. The hotel's facilities, layout, and ambiance were conducive to fostering an atmosphere of collaboration, creativity, and learning. The goal was to create a space that would inspire participants and facilitate effective communication and idea exchange.
b. Accessibility: The location of the venue was also an important factor. Athens, being the capital city of Greece, is well-connected and easily accessible for both local and international participants. This ensured that attendees from various backgrounds and regions could conveniently reach the venue, promoting inclusivity and maximising the diversity of perspectives.
c. Amenities and Services: The Stanley Hotel was chosen based on its amenities and services that aligned with the needs of the event. Factors such as spacious meeting rooms, audio-visual equipment, and reliable internet connectivity were considered to ensure that participants could comfortably engage in discussions, workshops, and collaborative activities. Additionally, the availability of amenities like refreshments,

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comfortable seating, and breakout spaces contributed to creating an environment conducive to networking and informal knowledge sharing.

d. Inspirational Setting: The choice of Athens as the location added an inspirational element to the event. Athens has a rich history and cultural heritage, serving as a source of inspiration for participants. The combination of the city's vibrant atmosphere, historical landmarks, and natural beauty provided an enriching backdrop for the Common Ground Camp. It contributed to creating a sense of inspiration and motivation among participants, fostering a conducive environment for ideation and collaboration.

All in all, the choice of an appropriate venue is of utmost importance as it plays a critical role in establishing an atmosphere that encourages collaboration, effective communication, and a rewarding learning experience. When selecting a venue, careful consideration of various factors ensures that the physical space aligns harmoniously with the event's objectives. By providing an environment that facilitates engagement, meaningful interactions, and a shared sense of purpose, venues significantly contribute to the overall success of such events. Thus, the selection of the venue holds immense value in shaping the ambiance and maximising the impact of similar participatory and cross-contamination activities.

5.1.3 Target Audience

Creating an Inclusive Platform for Bioeconomy Education

The Bioeconomy Common Ground Camp was thoughtfully designed to accommodate a wide range of participants from both formal and non-formal education communities. This included universities (10), education policymakers (8), school administrators (2), teachers (25), museums (2), science communicators (17), youth organisations (6), and community groups (17). By encompassing such diverse stakeholders as well as participants from other EU-funded projects and initiatives, the event aimed to foster collaboration, knowledge sharing, and the exchange of ideas among individuals with varied backgrounds and expertise.

Bringing together stakeholders from different backgrounds and sectors promotes a holistic and inclusive approach to bioeconomy education. It allows for a broader perspective, incorporating insights and experiences from various fields. Participants from universities bring academic expertise, policymakers contribute their strategic vision, regional authorities provide localised knowledge, teachers share their classroom experiences, museums and science communicators offer engaging outreach strategies, and youth organisations and community groups bring their unique perspectives and community engagement practices.

Figure 18: Common Ground Camp attendees

The benefits of such diverse representation are manifold. First and foremost, it enriches the dialogue and encourages interdisciplinary collaboration. By facilitating interactions among participants with different areas of expertise, the event encouraged the cross-pollination of ideas and the emergence of innovative approaches to bioeconomy education. It also provided an opportunity for networking and building lasting partnerships that can transcend the duration of the event.

Moreover, diverse representation ensures that the outcomes and solutions generated during the Common Ground Camp are relevant and applicable to various educational contexts. It allows for a comprehensive understanding of the challenges and opportunities associated with integrating bioeconomy concepts into different educational settings. By including participants from EU-funded projects and initiatives, the event fosters knowledge exchange, encourages the adoption of successful practices, and amplifies the impact of ongoing initiatives.

Overall, the diverse representation of stakeholders from different backgrounds and sectors at the Bioeconomy Common Ground Camp created a vibrant and inclusive platform for collaboration, enabling the exploration of multifaceted perspectives, the sharing of best practices, and the co-creation of innovative strategies for bioeconomy education, while at the same time stressed the importance of collective efforts and cross-sectoral partnerships in building a sustainable and bioeconomy-conscious future.

5.1.4 Educators Selection Process

Creating a Diverse and Engaging Learning Environment

The selection process for educators participating in the co-creation workshops was conducted meticulously, taking into account the diverse target age groups of the project (4-8-year-olds, 9-13-year-olds and 14-19-year-olds) to ensure a balanced representation among the attendees. A committee composed of experts from HSPN undertook the responsibility of reviewing applications and assessing the qualifications, experience, and alignment of the applicants with the objectives of the Common Ground Camp.

The committee sought educators who exhibited a strong passion for the bioeconomy, innovative teaching methodologies, and a track record of engaging students in sustainability-related topics. Furthermore, the committee carefully considered the target age groups, aiming to create a comprehensive and inclusive environment where educators from different educational levels could contribute their insights and perspectives.

By incorporating a balanced participation from educators of various age groups, the co-creation workshops encompassed a wide range of teaching approaches, methodologies, and resources tailored to the specific needs and interests of different age ranges. Educators working with younger students shared their experiences and strategies for engaging early learners, while those working with older students provided insights into captivating teenagers and young adults in bioeconomy-related topics.

The consideration of target age groups in the selection process resulted in a diverse and enriching environment, fostering meaningful discussions and the development of innovative teaching methods and approaches suitable for different educational contexts. This approach ensured that the co-creation workshops embraced a holistic and inclusive approach to bioeconomy education, accommodating the unique characteristics and learning needs of students at different stages of their educational journeys.

By employing a comprehensive selection process, the organisers ensured that the educators chosen for the co-creation workshops were highly qualified, motivated, and equipped with the necessary skills to contribute to the event's objectives. This thoughtful selection process laid the foundation for a collaborative and fruitful environment, where educators could share their expertise, exchange ideas, and collectively develop innovative teaching methods and approaches in line with the principles of the bioeconomy.

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5.1.5 Speaker Invitation Process

Curating Inspirational Voices: Bringing Bioeconomy Expertise to the Fore

The process of inviting speakers for the keynote talks and presentations of inspirational practices in the Common Ground Camp was carefully executed to ensure the selection of leading experts in the field of bioeconomy and sustainable education. Following multiple interactions within the project consortium, APRE and HSPN took the responsibility of identifying and reaching out to speakers who possessed the necessary knowledge and experience to contribute meaningfully to the event.

In the initial stages, thorough research was conducted to identify renowned experts and practitioners who had made significant contributions to the field of bioeconomy. These experts were chosen based on their expertise in relevant disciplines, their track record of accomplishments, and their ability to inspire and engage the participants.

After identifying potential speakers, the organising committee extended invitations to them, providing a comprehensive overview of the Common Ground Camp's context, goals, and themes. The committee emphasised the importance of their contributions in shaping the understanding of bioeconomy and sustainable education among the participants.

The selected speakers were chosen through a rigorous evaluation process that considered their expertise, experience, and relevance to the topics covered in the event. This approach aimed to provide a diverse and well-rounded set of perspectives to the participants, enriching their understanding and sparking new ideas and insights.

By inviting leading experts in the field, the Common Ground Camp ensured that the keynote talks were delivered by individuals who could offer valuable insights, share best practices, and inspire the participants. These talks served as a foundation for the event, setting the tone and providing participants with essential background information on the bioeconomy and its intersection with sustainable education.

Overall, the process of inviting speakers for the keynote talks and the presentations of inspirational practices involved a thorough evaluation and selection process, aiming to curate a line-up of experts who could contribute significantly to the participants' knowledge, inspiration, and engagement in the field of bioeconomy and sustainable education.

5.1.6 Theme and Focus

Bioeconomy Education for a Sustainable Tomorrow: Fostering Awareness, Collaboration, and Innovation

The Bioeconomy Common Ground Camp cantered around the intersection of bioeconomy and education, emphasising the importance of bioeconomy practices for a sustainable future and fostering a generation that embraces sustainability. The event focused on specific areas within the bioeconomy, such as circular economy, renewable resources, waste management, and

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sustainable agriculture, addressing key aspects essential for building a sustainable and bio-based economy.

An integral goal of the Common Ground Camp was to raise awareness among participants about the potential of the bioeconomy and its relevance in addressing global sustainability challenges. Renowned experts and practitioners delivered keynote talks, providing participants with essential background information on the bioeconomy. These talks also showcased inspiring educational tools and resources developed through EU-funded projects and other initiatives, offering fresh perspectives on teaching, learning, and disseminating information about the bioeconomy. The Group Work and Co-creation segment of the event played a vital role in actively engaging participants. Through collaborative activities in small groups, attendees were encouraged to share their expertise, exchange ideas, and develop innovative strategies and approaches to incorporate bioeconomy concepts into their educational practices. This participatory approach empowered participants to co-create novel teaching methods aligned with the principles of the bioeconomy.

The activities during the Bioeconomy Common Ground Camp were designed to provide participants with valuable insights, knowledge, and inspiration in several ways:

- **Keynote Talks and Presentation of Inspirational Practices**: Renowned experts and practitioners delivered keynote talks and showcased inspiring educational tools and resources developed as part of EU-funded projects as well as other initiatives. These talks offered participants essential background information on the bioeconomy and showcased practical examples of innovative approaches. By learning from experts and being exposed to successful projects, participants gained valuable insights into the potential and applications of bioeconomy concepts.
- **Information Exchange and Inspiration**: The Bioeconomy Common Ground Camp created a dynamic environment for participants to exchange information, gain valuable insights, and find inspiration in bioeconomy education. Attendees shared their expertise, experiences, and knowledge, fostering fruitful discussions and learning from each other's perspectives. This exchange of information provided diverse ideas and best practices, expanding participants' understanding of bioeconomy concepts and their potential applications. By learning from one another, participants discovered new possibilities for incorporating bioeconomy concepts into their teaching methods, sparking creativity and innovation.
- **Showcasing Innovative Tools and Projects**: The event featured the showcasing of innovative educational tools, resources, and projects related to the bioeconomy. These examples demonstrated practical applications of bioeconomy concepts and provided inspiration for participants. By seeing tangible models and successful initiatives, participants gained a deeper understanding of how bioeconomy education can be integrated into their own practices. This exposure to innovative tools and projects sparked creativity and inspiration, encouraging participants to explore new approaches and strategies in their educational practices.
- **Co-creation and Collaboration**: The Common Ground Camp emphasised the importance of active participation and collaboration among participants. Through group work,

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interactive discussions, and workshops, attendees were encouraged to contribute their expertise and exchange ideas. By engaging in collaborative activities, participants had the opportunity to co-create innovative teaching methods and approaches aligned with the principles of the bioeconomy. This collaborative environment fostered a collective learning experience, where participants not only gained knowledge but also inspired and learned from each other.

Keynote Talks and Presentation of Inspirational Practices

During this session, renowned experts and practitioners delivered keynote talks to provide participants with essential background information on the bioeconomy. These talks also showcased inspiring educational tools and resources that had been developed as part of EU-funded projects. The aim was to encourage fresh perspectives on teaching, learning, and disseminating information about the bioeconomy.

The presentations during the Bioeconomy Common Ground Camp covered a wide range of topics related to bioeconomy education, sustainability, and engaging different target groups:

Chiara Pocaterra (APRE) – Presentation of GenB project and aims of the workshop: Chiara Pocaterra, representing APRE, delivered a presentation introducing the GenB project and outlining the objectives and goals of the workshop. The presentation aimed to provide participants with an overview of the GenB project and set the context for the activities that would follow.

Giuseppe Pellegrino (EC) – The role of bioeconomy education in preparing citizens for the green transition [online]: Giuseppe Pellegrino, from the European Commission (EC) and project officer for the GenB project, gave an online presentation that explored the significance of bioeconomy education in equipping citizens for the green transition. The talk emphasised the role of education in creating awareness, fostering sustainable practices, and empowering individuals to contribute to a more sustainable future.

John Vos (BTG) – A brief introduction to the bioeconomy: John Vos, representing BTG, delivered a presentation offering a concise introduction to the bioeconomy. The talk provided participants with a foundational understanding of the bioeconomy, including its scope, key principles, potential applications and challenges. The presentation aimed to familiarise attendees with the fundamental concepts of the bioeconomy.

Miriam Molina Ascanio (EUN) – STEM Education in primary/secondary education in Europe: priorities and bioeconomy: Miriam Molina Ascanio, representing EUN (European Schoolnet), presented on STEM (Science, Technology, Engineering, and Mathematics) education in primary and secondary schools in Europe. The presentation discussed the priorities and initiatives in STEM education, with a specific focus on the relevance of bioeconomy within the STEM curriculum. The talk aimed to highlight the importance of incorporating bioeconomy concepts into science and STEM education at various educational levels.

Theodora Polyzoidou (HSPN) – Engaging the youth of today to protect the planet of tomorrow: The Eco-Schools Seven Steps methodology: Theodora Polyzoidou shared insights on engaging

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youth in environmental protection using the Eco-Schools Seven Steps methodology. The presentation focused on practical strategies and approaches for involving young people in sustainability initiatives, with an emphasis on the Eco-Schools framework. The talk aimed to inspire participants to engage and empower young individuals in environmental stewardship.

Susanna Albertini (FVA) – Inspiring and educating young generations: Innovative approaches from European Funded projects: Susanna Albertini presented on innovative approaches from EU-funded projects aimed at inspiring and educating young generations. The talk showcased successful projects and initiatives that employed creative methods and resources to engage young people in bioeconomy education. The presentation aimed to provide participants with examples of effective practices and innovative educational approaches to inspire their own work in bioeconomy education.

Rita Escórcio (EU Bioeconomy Youth Ambassadors) – The role of youth in bioeconomy education: Rita Escórcio, representing the EU Bioeconomy Youth Ambassadors, discussed the role of youth in bioeconomy education. The presentation emphasised the unique perspectives and contributions of young people in driving bioeconomy education forward. It aimed to highlight the importance of involving and empowering young individuals in shaping a sustainable bioeconomy.

Keren Dalyot (Weizmann Institute of Science) – EIT FoodScienceClass and the Youth Mission: Keren Dalyot presented on the EIT FoodScienceClass and the Youth Mission, focusing on initiatives aimed at stimulating youth interest in the field of food science. It showcased the educational tools, methodologies, and activities developed to engage young people in learning about food-related topics and fostering their curiosity in this area.

Sofoklis Sotiriou (Ellinogermaniki Agogi) – the FoodSHIFT2030 and CREATIONS projects: Sofoklis Sotiriou discussed the FoodSHIFT2030 and CREATIONS projects, which aim to address food-related challenges through innovative approaches. The presentation highlighted the materials, tools, and methodologies developed within these projects, focusing on their relevance to sustainable food systems, food innovation, and education. It provided insights into how these initiatives promote a multidisciplinary and collaborative approach to addressing food sustainability issues.

Pavlos Koulouris (Ellinogermaniki Agogi) – the SALL project: Pavlos Koulouris presented on the SALL project, which focuses on promoting active learning methodologies in schools. The presentation highlighted the materials, tools, and methodologies developed within the project, emphasising their application and impact on student engagement, participation, and knowledge acquisition. It provided examples of innovative teaching and learning approaches that can be applied beyond the bioeconomy context.

Mariangela Giunti (GSE) – Educational tools and materials in renewables: the experience of a public organisation: Mariangela Giunti shared the experience of a public organisation, GSE, in developing educational tools and materials related to renewables. The presentation showcased the resources and methodologies designed to educate students and the general public about

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renewable energy sources, their importance, and their impact on sustainability. It highlighted the role of public organisations in fostering awareness and knowledge in the field of renewables.

Line Friis Lindner (ISEKI-Food Association) – FoodSafety4EU project [online]: Line Friis Lindner presented on the FoodSafety4EU project, which focuses on food safety education. The presentation discussed the materials, tools, and methodologies developed within the project to enhance food safety knowledge and practices. It emphasised the importance of educating individuals about food safety and showcased innovative approaches for promoting safe and sustainable food consumption.

Christina Lundström (Swedish University of Agricultural Sciences) – The PREPSOIL experience: educational models in the soil area [online]: Christina Lundström shared the experience of the PREPSOIL project, which focuses on soil-related education. The presentation highlighted educational models and approaches developed within the project to enhance understanding of soil science, soil management, and the importance of soil conservation. It provided insights into effective educational strategies and resources for promoting sustainable soil practices.

Tremeur Denigot – Education for Climate Coalition, Joint Research Centre, European Commission [online]: Tremeur Denigot presented on the Education for Climate Coalition, an initiative supported by the Joint Research Centre of the European Commission. The presentation focused on the materials, tools, and methodologies developed within the coalition to promote climate education. It emphasised the importance of climate education and showcased resources and approaches for integrating climate-related topics into educational settings.

Bram Drijvers (Climate-KIC) – Young Innovators, Systems change begins in schools [online]: Bram Drijvers, from Climate-KIC, delivered a presentation on the role of young innovators in driving systems change, with a focus on the importance of schools in initiating and fostering sustainable practices. The presentation highlighted the potential of young people to contribute to the transition towards a sustainable future and showcased examples of successful initiatives led by youth in various domains.

Nadia Sansone (UNITELMA SAPIENZA) – Circular Bricks - Circular Bioeconomy for improving agrifood VET institutes' teachers' skills and competencies (Erasmus +) [online]: Nadia Sansone presented on the Circular Bricks project, which focuses on enhancing the skills and competencies of teachers in agrifood Vocational Education and Training (VET) institutes. The presentation discussed the project's objectives, methodologies, and outcomes, with a particular emphasis on the circular bioeconomy and its application in the context of agrifood education.

Agnes Renkin (b-nk) – Green Cool School project (Erasmus +) [online]: Agnes Renkin presented the Green Cool School project, which is implemented under the Erasmus+ program. The presentation highlighted the project's objectives and activities aimed at promoting sustainability and environmental awareness in schools. It showcased the innovative approaches and tools used in the project to engage students and teachers in adopting sustainable practices.

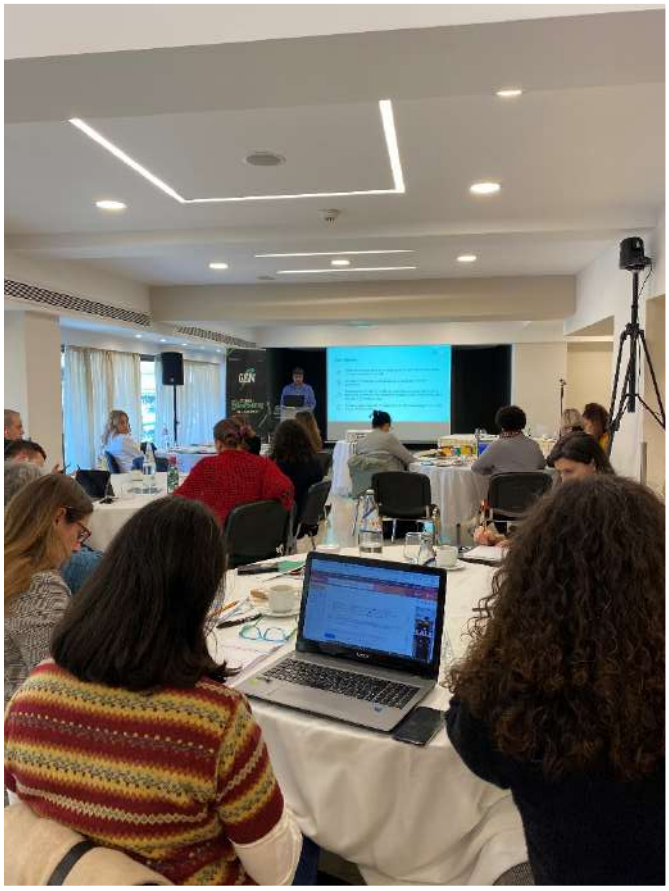

Figure 19: Keynote talks and presentations of inspirational practices in bioeconomy education

Pramod Kumar Sharma (FEE) – Presentation of the BioBeo project, its scope, main objectives, and outputs: Pramod Kumar Sharma delivered a presentation on the BioBeo project, providing an overview of its scope, main objectives, and outputs. The presentation focused on the project's activities related to bioeconomy education and raising awareness about the potential of the bioeconomy for sustainable development. It highlighted the project's impact and the resources developed to support bioeconomy education.

Isabel Pardo Baldoví & Clara Blasco (AIJU) – Keys and experiences to boost sustainability with children: Isabel Pardo Baldoví and Clara Blasco presented on the keys and experiences to promote sustainability among children. The presentation discussed practical strategies, tools, and activities to engage children in learning about sustainability and encouraging environmentally friendly behaviours. It showcased successful experiences and provided insights into effective approaches for promoting sustainability education among young learners.

Juliet Tschank (ZSI) – Boosting young European citizens' knowledge and awareness of the bioeconomy - practical examples from the BLOOM project: Juliet Tschank discussed the BLOOM project, which focused on enhancing young European citizens' knowledge and awareness of the bioeconomy. The presentation provided practical examples and case studies from the project, highlighting innovative approaches and methodologies used to engage and educate young people about the bioeconomy and its potential for sustainable development.

Giacomo Maria Rinaldi (UNIBO) – The BIObec project: implementing Bio-Based Education Centres to unlock the EU Bioeconomy: Giacomo Maria Rinaldi presented on the BIObec project, which aims to implement Bio-Based Education Centres to promote the EU bioeconomy. The

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presentation discussed the objectives, strategies, and outcomes of the project, emphasising the role of education in fostering a bio-based economy. It showcased the educational models and approaches developed within the project.

Gregor Cerar, Lucija Marovt (Društvo DOVES) – E-SPACE (Eco-Schools Project Advancing Circular Economy) - Slovenian experiences and inspiration [online]: Gregor Cerar and Lucija Marovt shared experiences and inspiration from the E-SPACE project, which focused on advancing the circular economy through the Eco-Schools initiative. The presentation highlighted the Slovenian experiences within the project and showcased practical examples of circular economy practices implemented in schools. It aimed to inspire participants with successful case studies and provide insights into implementing circular economy principles in educational settings.

John Vos (BTG) – Inspirational practice: The Allthings.bioPRO serious game: John Vos delivered a presentation on the Allthings.bioPRO serious game, which aims to educate and raise awareness about the bioeconomy. The presentation showcased the serious game as an innovative tool for engaging learners and promoting understanding of bio-based processes, technologies, and their potential applications. It highlighted the interactive and experiential learning opportunities offered by the serious game.

Ermioni Bachtse (QPlan) – BioGov.net Community of Practice and useful methodologies for designations, co-design workshops, and policy workshops: Ermioni Bachtse presented the BioGov.net Community of Practice, focusing on useful methodologies for designations, co-design workshops, and policy workshops in the context of bioeconomy governance. The presentation discussed collaborative approaches and participatory methodologies employed in the community to facilitate stakeholder engagement, decision-making, and policy development related to the bioeconomy.

Chiara Pocaterra (APRE) – Transition2bio & BIOVOICES: Open innovation approaches for the development of new models in bioeconomy awareness, information, and education: Chiara Pocaterra discussed the Transition2bio and BIOVOICES projects, which focused on open innovation approaches in bioeconomy awareness, information, and education. The presentation highlighted the projects' objectives and methodologies, emphasising the importance of engaging diverse stakeholders and promoting knowledge exchange for the development of new models in bioeconomy education and awareness-raising.

Group Work and Co-creation

During this session, participants actively engaged in group work and collaborative activities with a specific focus on co-creating new teaching approaches and methods that align with the principles of the bioeconomy. Through interactive discussions and workshops, attendees had the opportunity to share their expertise, exchange ideas, and collectively develop innovative strategies for integrating bioeconomy concepts into their educational practices.

Figure 20: Common Ground Camp – Group Work and Co-creation

The event fostered an environment that encouraged active participation and collaboration through the following means:

- **Brainstorming Sessions**: The event incorporated brainstorming sessions, which allowed participants to freely generate ideas, explore possibilities, and think creatively about bioeconomy education. These sessions created a space for open dialogue and encouraged participants to share their unique perspectives. Attendees were invited to contribute their expertise and actively participate in generating ideas that could shape the development of new teaching methods and approaches, in response to the following questions:
  - Why is it important to have younger generations driving the transition?
  - What are the key concepts to educate about within the context of bioeconomy?
  - What are your key insights after this event?
  - Which methodology, material, or tool from the ones presented most inspired you?
- **Group Work and Collaboration**: The event provided dedicated time for participants to work in groups. These groups consisted of individuals with diverse backgrounds, expertise, and perspectives. Participants were encouraged to collaborate with others, exchange ideas, and leverage their collective knowledge and experiences. This collaborative approach aimed to generate innovative solutions and strategies for

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integrating bioeconomy concepts into educational practices. Participants were grouped based on their respective backgrounds, aligning them with the target age groups of the project, Early childhood education, Primary education and Secondary education. Additionally, careful consideration was given to ensure that each group comprised a diverse range of stakeholders beyond formal educators. Following the world café methodology, participants were organised into groups to facilitate engaging and interactive discussions on:

- Where does the field of bioeconomy education stand currently?
- What do formal and non-formal educators need?
- What are the challenges / barriers?
- What do I want pre- and early-school students to learn about bioeconomy?
- What do I want elementary school students to learn about bioeconomy?
- What do I want middle and high school students to learn about bioeconomy?

- **Interactive Activities**: The Common Ground Camp featured interactive activities, such as a Mentimeter Game that stimulated active engagement among participants. These activities could include hands-on exercises related to bioeconomy education. By actively participating in these activities, attendees were able to apply their knowledge, share their insights, and collaborate with others in finding innovative solutions.
- **Expert Facilitation**: The event included expert facilitators who guided and encouraged participants throughout the group work, brainstorming sessions, and interactive activities. These facilitators provided guidance, facilitated discussions, and ensured that all participants had the opportunity to contribute their expertise and ideas. Their role was to create a supportive and inclusive environment that promoted active participation and collaboration.
- **Knowledge Sharing and Feedback**: The participatory nature of the event also involved sharing knowledge and providing feedback. Participants were given opportunities to present their ideas, projects, or experiences to the larger group. This allowed for peer-to-peer learning, constructive feedback, and the exchange of best practices. By sharing their expertise and receiving input from others, participants had the chance to refine their ideas and collectively create educational resources for bioeconomy education.

By emphasising group work, brainstorming sessions, and interactive activities, the Bioeconomy Common Ground Camp encouraged participants to actively contribute their expertise, exchange ideas, and collaboratively create innovative teaching methods and approaches. This participatory approach aimed to leverage the collective intelligence of the diverse group of attendees, fostering a collaborative and inclusive environment for the development of educational resources in bioeconomy education.

5.1.7 Conclusions

The preliminary planning and design phase of the Common Ground Camp was instrumental in establishing a solid groundwork for the event. During this phase, the organisers invested time and effort to carefully plan and structure the camp, ensuring that it would be a collaborative and engaging experience cantered around the themes of the bioeconomy and sustainable education.

One crucial aspect of the planning process was the selection of educators and speakers. The organisers made a conscious effort to invite a diverse range of educators and experts who possessed varied perspectives and expertise in the field. By doing so, they aimed to create a rich learning environment where participants could benefit from different viewpoints and gain a comprehensive understanding of the subject matter. This diversity of perspectives also encouraged critical thinking and stimulated meaningful discussions among the participants.

By bringing together a diverse group of educators and speakers, the Common Ground Camp was able to facilitate knowledge sharing and foster a sense of co-creation. Participants had the opportunity to learn from experts in the field, engage in interactive workshops, and exchange ideas with their peers. This collaborative atmosphere encouraged the development of innovative teaching approaches that integrated concepts from the bioeconomy and sustainable practices.

Moreover, the event served as a platform for participants to showcase their own ideas and projects related to the bioeconomy and sustainability. This emphasis on co-creation not only inspired creativity but also encouraged participants to actively contribute to the ongoing dialogue surrounding these important topics.

Ultimately, the Common Ground Camp aimed to inspire and empower the participants to become advocates for the bioeconomy and sustainable practices in their respective fields. By laying a strong foundation through effective planning, diverse perspectives, and active knowledge sharing, the event sought to ignite a passion for sustainable education and encourage the adoption of innovative teaching approaches that would inspire future generations to embrace the principles of the bioeconomy and sustainability.

In summary, the preliminary planning and design phase of the Common Ground Camp ensured that the event was collaborative, engaging, and focused on the bioeconomy and sustainable education. The selection of educators and speakers with diverse perspectives enhanced the learning experience, and the event provided a platform for co-creation and knowledge sharing. The ultimate goal was to inspire innovative teaching approaches and motivate participants to embrace the bioeconomy and sustainable practices, thereby creating a positive impact on future generations.

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5.2 Common Ground Camp Insights

This chapter gathers the insights from the co-creation activities developed in the GenB Common Ground Camp, held in Athens on 21-22 February 2023.

The face-to-face participants in the Common Ground Camp were distributed in a total of 4 groups each dealing with a specific age group:

- Early childhood education: 4-8 years old (1 group).
- Elementary school: 9-13 years old (1 group).
- Secondary school: 14-19 years old (2 groups).

Each group was composed by people from different countries and contexts, with specific experience in the age group in question. Each of these groups focused on thinking and designing activities, resources and educational proposals that would be interesting and effective in educating students of each age group in Bioeconomy.

Based on the co-creation work developed by the groups at the Common Ground Camp, the didactic proposals co-created for each age group are presented below, together with the posters created at the event and a detailed explanation of the activities.

5.2.1 Early childhood education

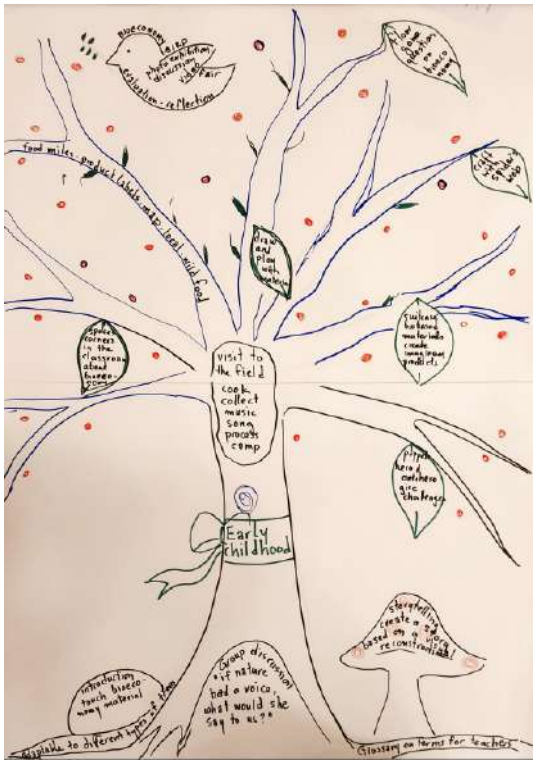

Figure 21: Co-creation proposal for early childhood education

The co-created proposal for early childhood pursues the following educational objective:

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- Learning about bioeconomy through the olive tree and its derived products.

The didactic proposal focuses on the olive tree, given the Mediterranean origin of most of the members of the group (Spain, Portugal, Greece and Cyprus), which makes it possible to join forces to protect this tree and move towards the bioeconomy. However, it is a proposal that can be adapted to any type of tree or species, whose potential lies mainly in starting from the reality of the students, connecting with their interests, daily life and previous knowledge to facilitate scaffolding and the construction of new significant learning.

In order to achieve this goal, a work and activity structure is presented that responds to the classic structure of the teaching-learning process: introduction - development - synthesis and conclusions. For this purpose, in accordance with the subject matter and the educational content, the metaphor of a tree is used, so that each of these phases is represented by one of the parts of the tree: roots (introduction), trunk and branches (development) and leaves and fruit (synthesis and conclusions).

However, the proposal also responds to a flexible approach, with the aim of being able to adapt the activities to the context of application and to personalise learning according to the characteristics of the target group. Thus, this structure can be modified, or a selection can be made from among the various activities proposed, which are described below.

In addition, it should be noted that the proposal includes the creation of a glossary of terms of interest for teachers, with the aim of facilitating the application of this didactic proposal.

Initial activities: introduction and contextualisation of the subject matter

The following activities are proposed to introduce and contextualise the learning topic:

- **Introduction** – Touch bioeconomy materials: This activity is based on sensory learning to introduce the topic and work on it in a manipulative and experiential way through the physical exploration of different bio-based materials and products. This allows children to actively interact with the materials, mainly through the sense of touch, but also involving other senses such as sight, smell, etc. This offers possibilities for interaction in real environments and facilitates knowledge and the creation of emotional links between the children and the subject matter.
- **Storytelling**: Storytelling is an educational tool with great potential, especially in early childhood, in which stories have a great symbolic power that allows bringing children closer to other realities, exploring their environment, exchanging ideas and opinions, recreating scenes from everyday life, and facilitating the understanding of abstract and complex concepts, such as the bioeconomy. Therefore, using visual support (scenes from illustrations or photographs from real life), this activity aims to create and tell stories to learn about the olive tree, other trees and the bioeconomy. Initially, the teacher (or adult staff) can create the story by presenting the illustrations to the children. After that, the children themselves can help to co-create the story, or invent new stories of their own. They can even draw pictures to tell and illustrate new scenes.

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- **Group discussion**: discussion groups are a didactic tool based on dialogical learning. They favour the understanding and internalisation of content and concepts through dialogue, discussion and the exchange of ideas and opinions. For this reason, it is proposed to carry out a discussion group based on the following key question: "If nature had a voice, what would it say to you?" This question challenges the children and facilitates empathy and connection with nature by putting themselves in its shoes. This is of great interest for learning about bioeconomy and rethinking the relationship between humans and nature. It therefore serves as a bridge to the development activities below.

Development activities: working on key contents

- **Puppets:** Puppets are a very interesting and effective educational resource to facilitate learning in early childhood. The characters and their stories allow children to identify with the scenes and experience adventures from other skins. For this reason, a story can be created and told with two puppets as protagonists: one the hero and the other the anti-hero, proposing challenges and problems to the children and explaining the bioeconomy concepts based on these characters.
- **Visit to the field**: a field trip can be organised to get to know the tree they are learning about first-hand. In this way, the children can see and touch the tree, learning about its shape, size, texture, etc. It would be a good idea for a farmer to accompany the group on the visit, explaining the harvest, how to care for the fields, etc. Different activities can be developed from this outing.
    - Camp: the visit to the countryside can be extended to a camp where they can tell stories, play outdoor games and gymkhanas, share experiences and learn about nature and bioeconomy.
    - Collect: the children can collect materials during the field trip, such as leaves, flowers, olives, etc., stressing to them the importance of caring for nature and not damaging trees. They can then use these materials to make murals, artistic compositions, etc.
    - Cooking workshop: a cooking workshop can be held with simple recipes that include olives as ingredients. Families can then be invited to taste the dishes and experience a moment of shared learning and socialising, which will also bring the bioeconomy closer to the families.
    - Songs and music: During the field trip, the children can learn a traditional work song that is sung in the fields. The farmer can teach them one and then they can perform it in class. Bio-based instruments can also be made, e.g., a maraca with the seeds of olives, to accompany the song.
- **Spaces corners in the classroom about bioeconomy**: different bioeconomy learning corners and environments can be created in the classroom where children are offered a variety of activities.

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- **Suitcase with biobased materials:** This activity consists of presenting the children with a briefcase containing different bio-based materials such as wood, leaves, wool, etc. This can be used to play different games and educational activities such as:
    - Talking and reflecting on the materials in order to be able to know and recognise them.
    - Create imaginary products: through these materials, children can become inventors, thinking about what objects or products can be made with them.
    - Draw and play with materials: children can make handicrafts and artistic compositions with them, drawings, games, etc. With the aim of exploring and manipulating the materials.
- **Craft with spider's web**: Spiders often spin their webs in the leaves of trees, so this can be explained to children, stories can be told, and crafts can be made to resemble the spider's web.
- **Floor game questions on bioeconomy**: games and dynamics such as quizzes, gymkhanas or floor games with questions and activities about the bioeconomy and the concepts learned. Examples of content may include the following:
    - Food miles: an interesting activity is to trace the path that food follows from production to consumption. The whole process can be recreated from the planting and cultivation of the olives to their harvest, their processing in the oil mill, their distribution, etc.
    - Product labels: research on product labels can also be interesting, with explanations adapted to the age of the children using dynamic and engaging activities.
    - Map of local and wild food: children can create a collaborative mural in which they classify local and wild foods. This activity can also be developed in a gamified way, with a memory, etc.

Synthesis and conclusion activities

- Photo exhibition: it can be organised an exhibition of photographs of the work carried out during the project, pictures taken during the field visit, etc. The teacher can also take photographs of natural elements and bio-based products and set up an exhibition to explain concepts to the children.
- Video: as a synthesis activity, a video can be made in which the children are the protagonists and tell a story about bioeconomy content with drawings made by themselves, explaining what the bioeconomy means to them, etc.
- Final discussion: It can be very interesting to establish a final discussion space in which children can share what they liked the most about the project, what they liked the least, and also some aspects they have learnt that they find curious or interesting, etc.

- Fair: a fair or a final event can be organised where the children's families are invited. It can be an excellent opportunity to show and share with the families the learning that the children have acquired in the process, and all the work that has been done. In this fair, the children can sing and play the songs they have learnt, watch the video, exhibit the murals and artistic creations, taste the recipes and dishes prepared, etc. In this way, the children would act as Young biovoices, becoming key agents in moving towards the transition.
- Evaluation – Reflection: Finally, after the whole process, it is necessary to carry out a group sharing in which the children have the opportunity to express their ideas and feelings about the project. So that this shared dialogue serves as a reflection and evaluation of the process and offers possibilities for further deepening of the subject matter in subsequent didactic proposals. The teacher should also reflect on the work carried out.

5.2.2 Elementary school

Two different didactic proposals for working on bioeconomy emerged in the group focused on elementary schools, which are summarised below.

1. Co-creation proposal 1 for Elementary School: The Bioeconomy olive tree

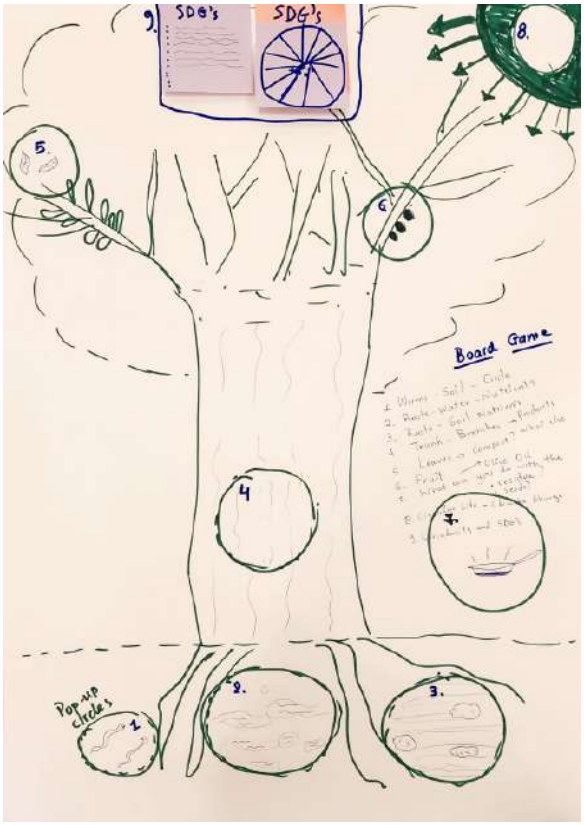

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Figure 22: Co-creation proposal 1 for Elementary School: The Bioeconomy olive tree

Based on the same metaphor used by the previous group, in this proposal bioeconomy education is developed on the basis of the olive tree, a characteristic tree typical of Mediterranean areas. In this case, the tree again provides a logical structure for the activities to be carried out.

The tree is used as a board game (can also be realised as a model or a book) with pop-up elements, so that each of them proposes a challenge to be solved by the students. In total, there are 9 different challenges that allow the students to work on different educational content related to the bioeconomy, which are explained below.

Initial activities: pop-up elements 1 to 3

- Pop-up 1: in this pop-up the children will learn about the role that worms and soil play in the growth and cultivation of trees by providing them with the substrate from which they can grow. In addition, the idea of circularity will be emphasised. The teacher (or adult) can tell them the story and then they can draw pictures that capture the process.
- Pop-up 2: this section explores the function of roots, which are responsible for providing trees with water. To learn about this, one can read the explanation, ask questions, etc.
- Pop-up 3: moving on from learning about the role of roots, the focus is now on the nutrients contained in the soil, and why it is so important to take care of it.

Development activities: pop-up elements 4 to 6

- Pop-up 4: this element explores the trunk and branches of the olive tree, from which we think and reflect on the products that can be derived from these elements: wood for heating, products made from wood, etc.
- Pop-up 5: This element focuses on leaves, exploring how they can be turned into compost or other useful products, and for what purposes they can be used.
- Pop-up 6: finally, the fruit of the olive tree is addressed: olives. It is possible to reflect and debate on the use of olives and olive oil, how they are processed and distributed, what purposes they can be used for: food, cosmetics, etc.

Synthesis and conclusion activities: pop-up elements 7 to 9

- Pop-up 7: Once the fruit of the olive tree has been explained, a debate or group discussion can be organised to address the following question: What can you do with the residue/seeds? The children will be asked to think of possible solutions to this problem, and based on this question, different challenges can be set for the children to reuse the olive seeds through workshops, dynamics and activities.
- Pop-up 8: Focusing on the sun as a source of energy for living beings, including for the growth and survival of the olive tree, we can also organise dynamic discussions on climate change, how it can be combated, and how it is already affecting living beings today. In addition, the circularity of nature can also be explained.

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- Pop-up 9: Finally, activities can be designed to link circularity with the SDG (Sustainable Development Goals) and thus be able to move towards bioeconomy.

2. Co-creation proposal 2 for Elementary School: Olive challenges

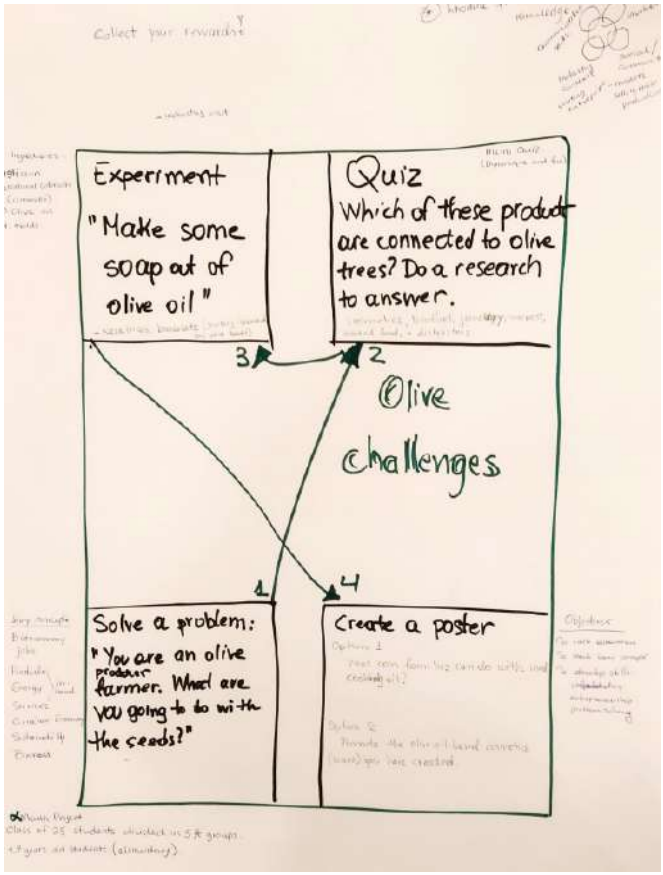

Figure 23: Co-creation proposal 2 for Elementary School: Olive Challenges

This didactic proposal pursues the following learning objectives:

- To teach about basic bioeconomy concepts.
- To Raise awareness of the importance of the bioeconomy: waste reduction, reuse of products and materials, etc.
- To develop green and soft skills, such as: problem-solving, collaboration and entrepreneurship.

It should be noted that this didactic proposal is designed to be worked with children between 9 and 12 years old, and that the project is based on a timetable foreseen for one month of work. In all the activities, the children will work in groups, in order to facilitate scaffolding and positive interdependence.

Focusing again on the olive tree, this proposal is based on Project-Based Learning or Problem-Based Learning, through five different phases that allow the curricular contents to be worked

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on gradually, each one of these phases proposing challenges to the students through different activities and dynamics, as explained below.

Whenever students overcome a challenge, they will receive a reward in the form of "green points" that will allow them to access the next challenge, so that the project will follow a gamified logic that will act as a motivational factor, increasing student engagement.

To complement the proposal, it is suggested to create and offer a glossary of basic concepts for teachers, including the following terms: Bioeconomy, bioeconomy related Jobs, Biobased products, services, circular economy, waste, sustainability, biomass.

Challenge n. 1: The olive farmer case

As an introduction, the didactic potential of storytelling is used to present students with the story of an olive tree farmer who has a problem with the waste generated by the trees, especially the seeds. His government suggests that he should look for a solution through ideas that will allow him to reuse the seeds, otherwise he will have to pay a high tax.

The story can be presented to the children in different formats, depending on the characteristics and interests of the class group. For example, role-playing can be used by staging the story with actors, an app can be used to create an animated video, the children can receive a letter or email in which the farmer asks for their help, etc.

The aim is to create interest among the children, so that they can connect with the story, empathising with the farmer's situation and thus generating an emotional bond that motivates them to continue working on the project.

Based on this scene, the following challenge is presented:

"You are an olive grower/farmer. What can you do with the seeds?"

Based on this question, a debate or group discussion should be set up in which the children think of preliminary solutions to reduce this waste. First of all, brainstorming can be done in each group, followed by a group discussion to start the debate.

Challenge n. 2: Olive Research & Quiz

After having connected with the story, the children will be asked to carry out research through different educational resources, e.g., books, manuals, WebQuests, previously selected websites, etc. in which they can look for information on ways of reusing organic waste such as olive seeds.

To do so, they will be provided with a glossary with basic concepts and a guide with some questions that will allow them to investigate bio-based products such as: cosmetics, compost, biofuel, etc.

The groups will work to answer these questions and create an educational resource with the results. For example, a mural, a diagram, an infographic, a PowerPoint presentation, etc.

In addition to answering these questions, they will be challenged to think of other uses for olive seeds, e.g., jewellery, soap, etc..., appealing directly to their imagination and creativity.

Finally, to synthesise and consolidate the learning achieved in this research phase, students will be asked to complete a gamified questionnaire, carried out with an app such as Kahoot or Mentimeter, with which they can review the worked concepts in a fun and dynamic way.

Challenge n. 3: Experiments and workshops

In this phase, workshops and experiments are proposed so that the children can put into practice what they have learned in the previous phases. These activities are attractive and dynamic and allow the learning transfer, encouraging entrepreneurship. In addition, they are more meaningful for the students, because they present them with challenges and connect with manipulative learning.

- Experiment: Let's make some soap: in this activity, students are offered an experiment aimed at making soap from waste oil. In this way, a bio-based product is created while at the same time focusing on waste reduction. The ingredients needed to create the natural soap are olive oil, glycerine, natural colorants (such as cinnamon) and moulds.
- Jewellery workshop: children can create jewels such as necklaces, bracelets, earrings, etc., using the seeds of olives. They can paint them in colours and knot them using wool or string.

Challenge n. 4: Create a poster

After having participated in the workshops and experiments, the students will be asked to create posters that reflect what they have learnt and serve to encourage positive attitudes and promote progress towards the bioeconomy. To this end, each of the groups will be responsible for a different theme:

- Raising awareness among families: one of the groups will make a poster to raise awareness among families and explain what they can do with the used oil.
- Promotion of bio-based products: another poster will promote the consumption of bio-based products, explaining what they are, what types exist and why it is important to buy them compared to other options.
- Promotion of bio-based cosmetics: another poster will be used to advertise bio-based cosmetics, especially the soap created by the students.
- Promotion of bio-based jewellery: another poster will encourage the purchase of bio-based jewellery, such as those produced by children.

Challenge n. 5: Celebration of a BioFair

Finally, to make the whole learning process visible and share it with society, as a final product of the project, the students will organise and hold a BioFair where they can sell the bio products they have created: both the natural soap and the jewellery made from seeds.

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In addition, this fair will also have exhibition spaces where the students can showcase their creations and where they can develop dissemination and communication activities to raise awareness among attendees: families, teachers and students from other grades, etc.

In this sense, the BioFair will allow them to work on multiple skills, abilities and competencies, such as communication skills, as well as various soft skills such as entrepreneurship, leadership, social commitment, etc.

In short, the BioFair will link up with the concept of open science and open learning, connecting school with reality and allowing students to take an active and leading role in the transition towards the Bioeconomy.

5.2.3 Secondary school

Finally, Secondary Education was addressed by two groups, which developed different proposals to approach Bioeconomy with students at this educational stage, which are presented below.

Co-creation proposal 1 for Secondary School: BioMarathon

Figure 24: Proposal 1 for Secondary Education: BioMarathon

One of the groups proposed a BioMarathon to promote the development of pro-environmental attitudes among students, in a dynamic and attractive way, thus encouraging student engagement and progress towards the Bioeconomy.

This BioMarathon is understood as a competition that encourages students to reach challenges and stages, so it can be a highly motivating proposal for teenagers, who are interested in both competitive games that allow them to overcome and collaborative activities that enable them to relate and interact with others, joining efforts and creating community. Therefore, this activity has the perfect characteristics to train students at this stage.

The activity is aimed at students between 13 and 19 years old and is designed to allow all school classes to participate at the same time, being understood as a school competition.

As a globalising project that can integrate various curricular areas and contents, the BioMarathon will allow the development of systemic thinking.

In terms of time planning, its development is planned for a school year, although with a duration of 3 to 6 months. An interesting proposal could be to start the activity on the commemoration of Food Waste Day (September 29) and finish it at Easter, to coincide with the end of the school term before the vacations. Choosing a specific date can act as a motivating element, since the challenge of the BioMarathon can be linked to this aspect, and it can also provide an opportunity to talk and reflect on the topic in question.

As possible proposals for topics to serve as a common thread for the BioMarathon, the following are proposed: 1) Reduce and reuse; 2) Local biomass: how to use it, how to treat it, etc.; and 3) Food waste.

These topics can be changed so that each year a challenge is defined in the school, being the BioMarathon an annual event that is repeated each school year with a new objective.

To develop this proposal, it is necessary to transmit the message clearly, that is, to make the objective to be achieved explicit, through an effective communication strategy that motivates students and encourages them to get involved in the project. It is also necessary to establish realistic and progressive challenges that allow the students to gradually reach the objectives. For this, it is necessary to make a collaborative diagnosis of needs and the current situation in order to start by changing current habits and move towards pro-environmental attitudes.

The BioMarathon can include different activities such as: experiments, Living Labs, co-creation spaces, social innovation actions (such as events with the community), excursions (such as a visit to a biorefinery or a factory), competitions and contests, and activities that allow connection with local stakeholders, artistic activities to communicate the message through art (music, painting, sculpture, etc.), as well as the realisation of a Hackathon, etc.

Finally, in order to clearly visualise the results, it would be convenient to have a big board where the progress and activities to be developed step by step could be shown. This, in turn, would act as a motivating element.

Co-creation proposal 2 for Secondary School

Regarding the proposal of the second group to train secondary school students in Bioeconomy, this group did not focus on designing a specific didactic proposal (Lesson plan), but rather on offering proposals on different aspects that can contribute to address this topic at the secondary school stage, such as: didactic tools and work dynamics, as well as the role of art and role-playing, the possibilities of intergeneration or the expected impacts. Each of these elements will be detailed below.

Didactic tools to boost Bioeconomy in Secondary School

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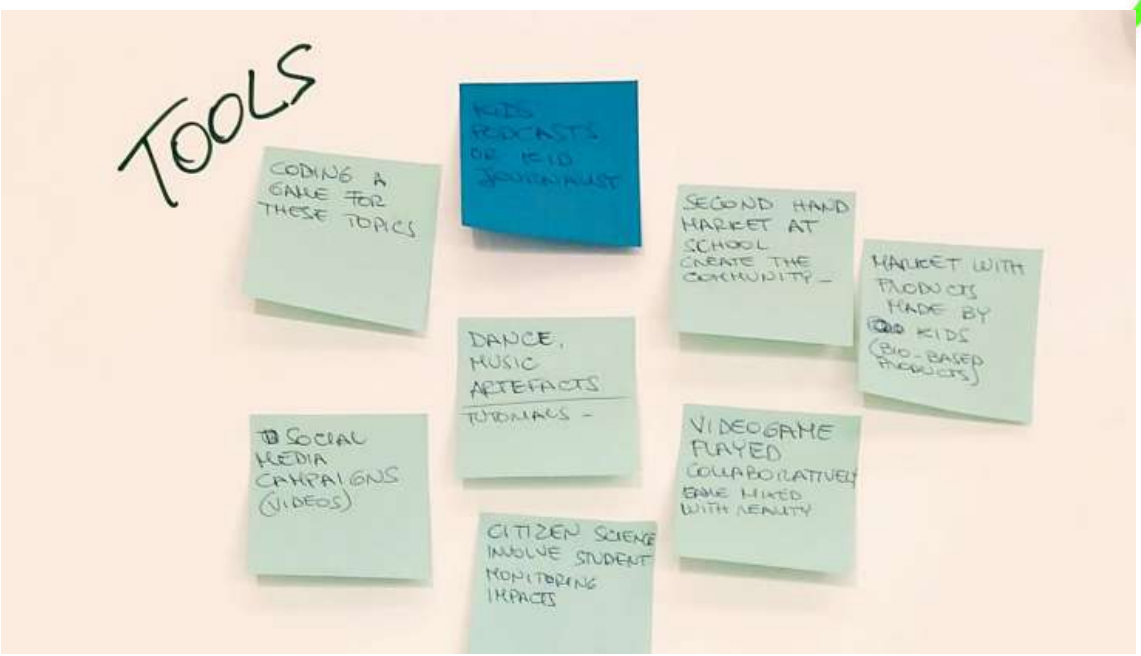

Figure 25: Didactic tools for Secondary School

As regards didactic tools, the following are proposed:

- Coding a game for these topics: gamification is an excellent teaching tool to promote student motivation. Therefore, creating a game that proposes challenges can be very appropriate to learn about bioeconomy in a funny way. It can be used a QR code that students must scan, in order to connect with their digital interests and promote the use of digital technologies; make a quiz with digital applications such as Kahoot or Mentimeter, or even opt for other more traditional games. These gamified solutions might also embed educational cards or contents that the students unfold while playing.
- Videogames: This is a very attractive resource for students, which allows them to learn and work on curricular content but from a playful perspective. Creating or playing games about bioeconomy can be an excellent learning resource.
- Market – Fair: The celebration of markets or fairs can also capture the attention of students while encouraging the commitment and participation of society. In this way, students act as influencers, becoming protagonists in the transition to the bioeconomy. One option is to organise a market with second-hand products in which anyone in the educational community can offer their objects that they no longer use or want to give them a second life. Another possibility is to sell bio-based products created by the students themselves, such as natural soap, notebooks made from recycled paper, etc.
- Social Media: Social networks have a great potential to attract students' interest and to transmit messages in a motivating and attractive way. Therefore, they can be used from a didactic perspective to address curricular content. One proposal would be to work on the content of influencers who create content on Bioeconomy, or to create it themselves. Campaigns can be developed with the use of hashtags, promotional videos,

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etc. Influencers active in other sustainability domains (e.g., zero waste) might also be involved and informed/educated with regards to the bioeconomy.

- Citizen science: Another idea is to opt for one of the open science or citizen science proposals, trying to engage the community. Students should become the protagonists of the process, making decisions, taking action and assuming leadership, but with social purposes that have an impact on applied and real improvement. In such a way that there is a transfer of learning, a tangible learning.
- Arts: Dance, music and art in general can also contribute to learning about and promoting the bioeconomy. Students can create artistic creations such as a song, a choreography or a painting that raise awareness about bioeconomy. In addition, they can also create DIY (Do-it-yourself) bio-based products or prototypes.
- Podcasts / Journalists: students can become journalists by creating content to spread the word about the bioeconomy in different formats such as podcasts, magazines, pamphlets, blogs, etc.

Learning dynamics to boost Bioeconomy in Secondary School

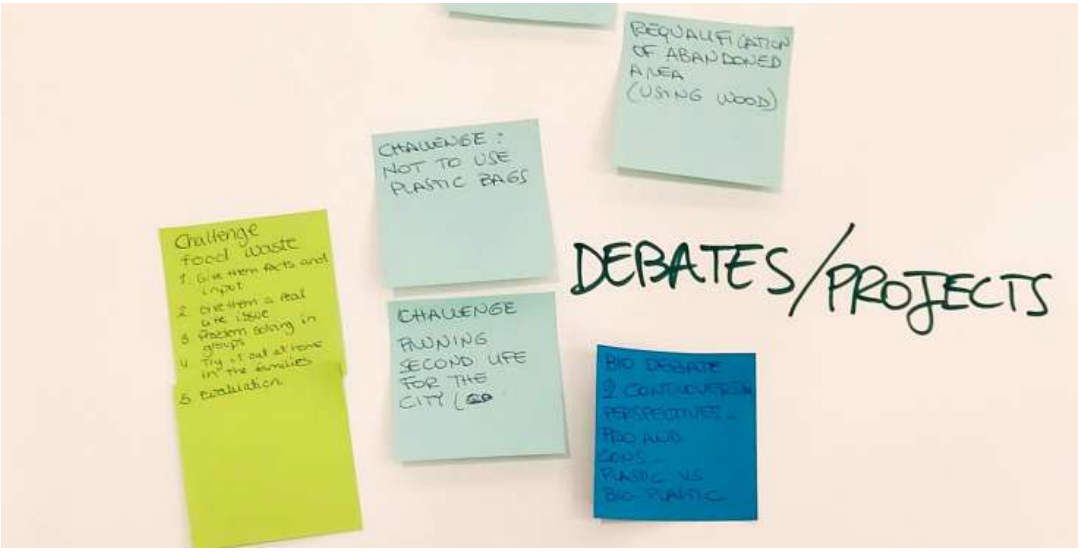

Figure 26: Learning dynamics for Secondary School

Regarding learning dynamics to address the bioeconomy in Secondary Education, debates and discussion groups can be an excellent dynamic for students to express and exchange their ideas, reflect on problems, think about solutions, etc. Thus, controversial topics can be discussed and debated, such as, for example, the pros and cons of using plastic versus bioplastic. These challenges (or enquiry-based learning) can be connected with traditional curricula (e.g., science, biology, civic education).

Different themes and projects are proposed, as well as challenges to be addressed by the students, such as:

- Challenge n.1: Food Waste

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- Challenge n. 2: Not to use plastic bags.
- Challenge n. 3: Pruning second life for the city.
- Challenge n. 4: Requalification of an abandoned area (using wood).

To address these challenges, a process is proposed in which students can take an active and leading role. To do this, it is necessary to provide information and real facts that represent a problem in their lives, to connect with their interests. From this, students will work in groups to find solutions to this problem, developing soft skills such as problem solving. Once the solutions have been found, students will be asked to apply them in their daily lives and with their families. Finally, an evaluation will be carried out.

The role of art and role-playing in Bioeconomy training in Secondary Education

Figure 27: Potential of art for bioeconomy education in Secondary Education.

Art can also be used from a didactic perspective that allows students to handle and understand the contents related to the Bioeconomy leveraging on the emotions connected to art.

For example, artistic creations and compositions can be made with waste or garbage, to give a second life to these elements, favouring reduction and reuse, and stimulating the mind-set change towards more sustainable behaviours.

Fashion can also adopt the values of the bioeconomy, creating clothes from bio-based materials, or repurposing old garments that will no longer be used. The awareness that there is another way to approach fashion contributes to deep thinking and attitudinal change.

Finally, music, theatre and drama, painting, sculpture, etc., can also be effective ways to learn about bioeconomy. For example, a play can be staged to explain how grapes end up becoming biofuel, from the perspective of a character representing the grape.

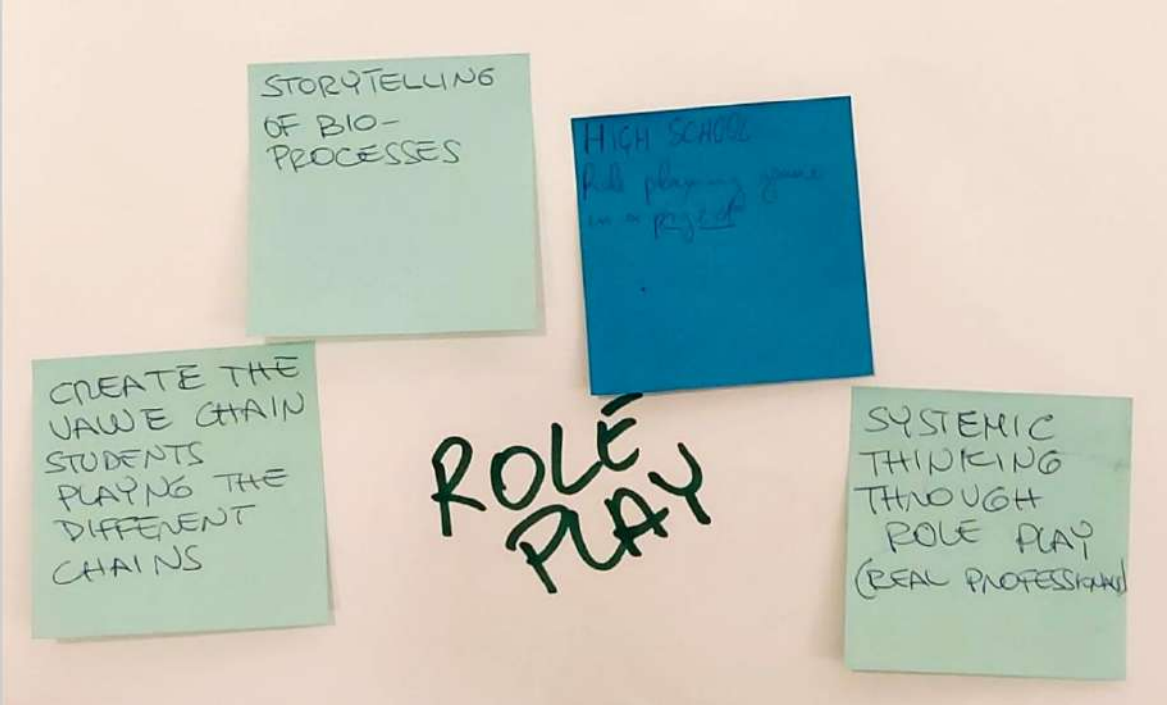

Figure 28: Potential of role-playing for bioeconomy education in Secondary Education.

As mentioned above, role-playing also offers didactic possibilities. For example, storytelling can be used to tell the life cycle of materials or bioprocesses. The wave of chains can also be staged, with each group of students acting out different chains.

In short, art can also be used to work on systemic thinking, e.g., staging real-life situations and problems, with professions related to the bioeconomy.

Understanding the impacts of our behaviours

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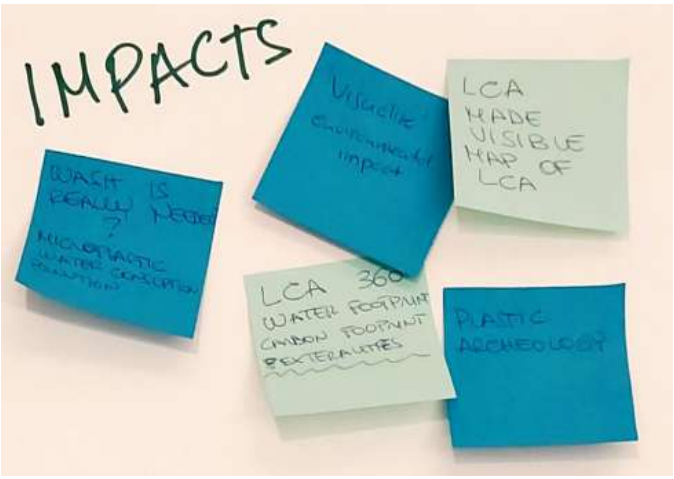

Figure 29: Art Potential for Bioeconomy Education in Secondary Education

In terms of impact, the following proposals are made:

- Visibilising Life Cycle Assessment (LCA): e.g., mapping LCA, tracking water footprint, carbon footprint, etc.
- Plastic archaeology: exploring and reducing plastic archaeology can also be an interesting impact proposal.
- Visibilise environmental impact: e.g., climate change, pollution, problems for animal and plant species, etc.
- Dialogue and reflection on greenwashing.
- Address different environmental issues such as: microplastics, water consumption, etc.
- Understanding that all our behaviours have an impact on the environment. How can we decrease our footprint?

Intergeneration

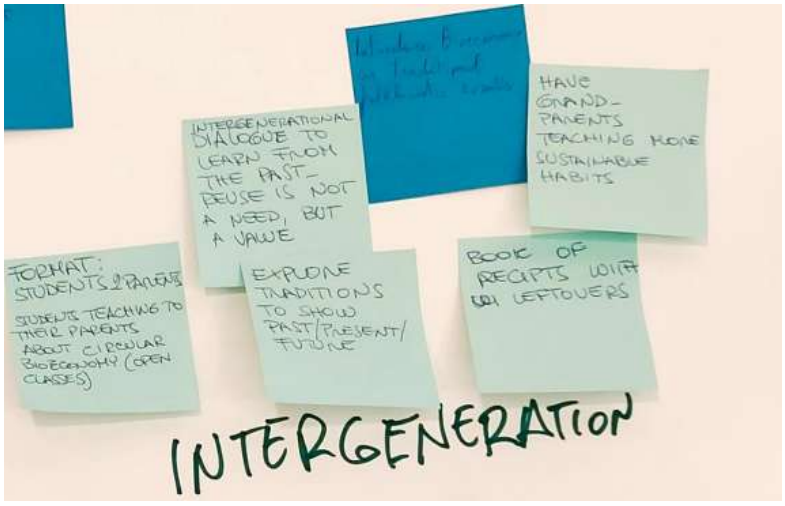

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Figure 30: Intergeneration in Secondary School

Finally, another fundamental aspect is to connect different generations in order to join efforts and move towards the Bioeconomy in a shared way.

For example, the connection with families is one of the most desirable and key aspects. Students can transmit to their families everything they have learned and influence them to change their habits. This can be done through open classes, fairs, or different events.

An intergenerational dialogue that allows students to learn from the past and emphasises the importance that reusing is not only a necessity, but also an important value to be rescued and preserved, can also be promoted. Traditions from the past can also be explored to establish bridges and links between past, present and future. The bioeconomy bridges the traditions and the innovation, for instance by exploring new properties of what today is considered waste, but in the past was a resource for the families.

To reduce food waste, students can create a cookbook with recipes for using leftovers, with the objective of putting them into practice in their homes with their families.

Talks or meetings with grandparents can also be organised to share experiences on sustainable habits.

Finally, it is interesting to notice that being frugal nowadays is not anymore, a need, like in the past, but it is a choice.

6. Part four: Focus Groups

The focus groups were chosen as an important social innovation tool and conducted by GenB researchers and teachers given their expertise on the transmission of knowledge to young students. The focus group sessions were conducted with students in 3 groups based on age (4-8 y/o, 9-13 y/o, 14-19 y/o). In most of the cases they were carried out physically, while some of them were conducted online, but the structure, methodology and data retrieval was kept homogeneous in all cases.

The details of the focus groups are presented below. Firstly, information is provided on the methodology, describing the participants, the context and conditions in which the focus groups took place, information on the moderators of the sessions, the ethical procedures and the structure and content of the sessions.

Moreover, the results of sessions per target group are presented with insights from students' interests, and their preferences on the proposed educational formats. Lastly, the conclusions of the sessions with an overview of the most preferred educational formats and a specific conclusion about them for each target group is included. For each of these sections and age groups, a general overview of the countries as a whole is provided first, followed by country-specific information.

6.1 Methodological aspects

A Focus Group is a qualitative research technique consisting of a group interview that allows for an in-depth inquiry into the perceptions and visions of the participants. According to Morgan (1997, 1998), it consists of a technique that allows the collection of information narrated in the first person by the participants, through their interaction on a topic presented by the researcher.

Regarding its applications, as Stewart et al. (2007) suggest, this technique allows for the following:

- To obtain information on a topic of interest.
- To stimulate new ideas and creative concepts.
- To generate and collect impressions on topics, products, etc.
- To analyse and validate results previously obtained with other techniques.

Based on these possibilities, within Work Package 1 of the GenB project, focus groups with students and teachers have been developed as one of the co-creation tasks. Specifically, the purpose of these activities has been to validate the methodologies and didactic proposals created in the Common Ground Camp of the project, held in Athens on 21st-22nd February 2023. In the focus groups, these proposals were presented to the students by the GenB Project researchers or by their own teachers, with the aim of finding out the preferences and interests of the children and young people in relation to these proposals, obtaining first-hand information from the target group itself.

Details of the methodological aspects of this activity are set out below. First, the principles about the ethical procedures are detailed. Second, details about the focus group participants are presented, both at a general and country-specific level. This is followed by a description of the conditions under which the focus groups were conducted, including technical details. Then, details on the moderators in each country are presented. Subsequently, information is provided on the aspects and procedures that were followed to ensure the ethical conduct of the research. Finally, the procedure and contents of the focus groups are described, both to gather the interests of the participants and to validate the proposals for bioeconomy education co-created in the Common Ground Camp.

6.1.1 Ethical procedures

Ensuring ethical guarantees in research is one of the priority aims of all the partners in the GenB Project. In order to fulfil this purpose, the actions and procedures necessary to ensure compliance with the ethical aspects of the research were taken into account in the development of the focus groups.

The general ethical procedures considered in the development of the focus groups can be summarised in three principles: a) voluntary participation and non-coercion, b) informing participants on the aims and implications of the research, and c) informed consent.

6.1.1.1 Voluntary participation and non-coercion

One of the main ethical issues in research involving human subjects is that their participation must be completely voluntary, and their informed consent must be obtained in advance (clearly documented).

Therefore, all students and teachers participating in the GenB Project focus groups were recruited on a completely voluntary basis.

6.1.1.2 Information and understanding of the research implications

Before participating in the activity, the participants received detailed information about the project and, in particular, about the task they are going to take part in and its implications. In addition, they were given the possibility to ask questions and clarify doubts.

6.1.1.3 Informed consent

To ensure that people participate voluntarily and that they have been adequately informed of the objectives and implications of the research, all participants (or their legal representatives in the case of minors) were asked to complete and sign an informed consent form (see Annex 6.2) before the focus groups were held.

6.1.2 Participants description: overview

Focus groups have been implemented by three GenB project partners: AIJU, HSPN and EUN, each one of them has implemented the activity in its field of influence. Specifically, AIJU has developed the focus groups in Spain, HSPN has implemented them in Greece and EUN has implemented them in several countries, as it always operates at international level. In total, 11 European and 3 South-East Asian countries were reached: Spain, Greece, Romania, Italy, Sweden, Portugal, Serbia, Croatia, Bulgaria, Ireland and Republic of North Macedonia, on behalf of Europe; and India, Turkey and Pakistan on the South-East Asian countries' side.

Table 2 summarises information on countries where GenB focus groups have been held.

	COUNTRY	STUDENTS	TEACHERS
	Spain	51 (31 AIJU + 20 EUN)	1
	Greece	44 (32 HSPN + 12 EUN)	1

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	Romania	214	8
	Italy	178	4
	Sweden	23	1
	Portugal	25	2
	Serbia	25	1
	Croatia	20	1
	Bulgaria	7	1
	Ireland	29	1
	Republic of North Macedonia	80	1
	India	50	2
	Turkey	119	4
	Pakistan	45	1
TOTAL	**COUNTRIES: 14**	**STUDENTS: 910**	**TEACHERS: 29**

Table 2. General summary of participants in the GenB focus groups

Participants in a focus group should have some common characteristics to facilitate their interaction and discussion on the research topic (Krueger & Casey, 2009). For example, they should belong to the same age group. Based on this premise, focus groups with 3 age groups have been developed within the framework of the GenB project:

- Early childhood education: 4-8 years old.
- Elementary school: 9-13 years old.
- Secondary school: 14-19 years old.

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As far as the participants are concerned, the focus groups in Spain and Greece were carried out with pupils of these 3 age groups. In both cases, AIJU and HSPN recruited participants through their network of collaborators, with children's participation being completely voluntary.

On behalf of EUN, after an open call for teachers from different countries, the selected teachers developed the focus groups with their own group of students. EUN then held online focus groups with teachers to gather information that emerged from the classroom discussions, and to collect students' preferences and views. A total of 29 international Early Childhood Education (ECE), Primary and Secondary school teachers from 14 countries were selected by EUN for the implementation of the focus groups. The selected teachers performed classroom discussions with their students according to the materials provided by AIJU and gathered their students' opinion on the proposed GenB materials. The classroom discussions covered a total of 847 students from early childhood to secondary education. Teachers then shared their students' insights as well as their own views, in heterogeneous online focus groups organised and moderated by EUN. A total of 4 focus groups sessions of 1 hour per session were conducted online, with an average of 7 teacher participants per session.

Table 3 summarises the global information on focus group participants, covering all countries.

STUDENTS		TEACHERS	
AGE GROUP	**Nº OF STUDENTS**	**EDUCATIONAL STAGE**	**Nº OF TEACHERS**
4 – 9 y.o.	101	Early childhood	4
9 – 13 y.o.	401	Primary Education	15
14 – 19 y.o.	408	Secondary Education	10
TOTAL	**910**	**TOTAL**	**29**
TOTAL OF STUDENTS AND TEACHERS			**939**

Table 3: Summary of participants in the GenB focus groups by age group and educational stage

As can be seen in Table 3 a total of 910 students and 29 teachers participated in the focus groups, giving a total of 939 participants. Details of the focus groups in each country are described below.

6.1.2.1 Spain: participants' description

A total of 31 students participated in the focus groups in Spain, with the distribution by age group summarised in Table 4.

AGE GROUP	NUMBER OF PARTICIPANTS
4 – 9 y.o.	10
9 – 13 y.o.	11
14 – 19 y.o.	10

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TOTAL	31

Table 4: Summary of participants in the GenB focus groups in Spain by age group

Details of the participants in each age group are specified below.

Focus Group 4-8 y.o.: number of participants and personal data

For the 4-8 age group, there were a total of 10 participants in Spain, whose main data are shown in Table 5:

PARTICIPANTS	AGE	GENDER	LOCATION'S POPULATION
Participant_1	**6**	**Female**	More than 200,000
Participant_2	6	**Male**	**More than 200,000**
Participant_3	8	**Female**	**More than 200,000**
Participant_4	7	**Female**	**More than 200,000**
Participant_5	6	**Male**	**More than 200,000**
Participant_6	7	**Female**	**More than 200,000**
Participant_7	8	**Female**	**More than 200,000**
Participant_8	8	**Male**	**More than 200,000**
Participant_9	6	**Male**	**More than 200,000**
Participant_10	6	**Female**	**More than 200,000**

Table 5: Spain Participants (4-8 years old): age, gender and location

The participants in the focus group did not know each other and had no previous relationship. Rather, they were specifically invited by AIJU to participate in the session because of their interest in environmental issues.

Focus Group 9-13 y.o.: number of participants and personal data

In Spain, a total of 11 students participated in the focus groups for the 9-13 age group, whose main data are shown in the Table 6 below:

PARTICIPANTS	AGE	GENDER	LOCATION'S POPULATION
Participant_1	**10**	**Female**	**More than 200,000**
Participant_2	**10**	**Female**	**More than 200,000**

Participant_3	12	Male	More than 200,000
Participant_4	12	Male	More than 200,000
Participant_5	9	Female	More than 200,000
Participant_6	12	Female	More than 200,000
Participant_7	12	Male	More than 200,000
Participant_8	11	Male	5,001–30,000
Participant_9	12	Male	5,001–30,000
Participant_10	11	Female	More than 200,000
Participant_11	12	Female	More than 200,000

Table 6: Spain Participants (9-13 years old): age, gender and location

In general, most of the participants in the focus group did not know each other and had no previous relationship. Rather, they were specifically invited by AIJU to participate in the session because of their interest in environmental issues. As exceptions, it should be noted that Participant_1 and participant_2 were classmates.

Focus Group 14-19 y.o.: number of participants and personal data

In Spain, a total of 10 students participated in the focus groups for the 14-19 age group, whose main data are shown in the Table 7 below:

PARTICIPANTS	AGE	GENDER	LOCATION'S POPULATION
Participant_1	15	Female	More than 200,000
Participant_2	15	Male	More than 200,000
Participant_3	14	Female	More than 200,000
Participant_4	14	Female	More than 200,000
Participant_5	14	Female	More than 200,000
Participant_6	19	Female	More than 200,000
Participant_7	19	Male	More than 200,000
Participant_8	17	Female	More than 200,000
Participant_9	19	Female	More than 200,000

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Participant_10	**17**	**Male**	**More than 200,000**

Table 7: Spain Participants (14-19 years old): age, gender and location

In general, most of the participants in the focus group did not know each other and had no previous relationship. Rather, they were specifically invited by AIJU to participate in the session because of their interest in environmental issues.

As exceptions, it should be noted that Participant_1 and Participant_2 were friends; Participant_4 and Participant_5 also knew each other because they were classmates. Finally, Participant_7 and Participant_8 were siblings.

6.1.2.2 Greece: Participants' description

A total of 32 students participated in the focus groups in Greece, with the distribution by age group summarised in Table 8.

AGE GROUP	NUMBER OF PARTICIPANTS
4 – 9 y.o.	8
9 – 13 y.o.	11
14 – 19 y.o.	13
TOTAL	32

Table 8: Summary of participants in the GenB focus groups in Greece by age group

Details of the participants in each age group are specified below.

Focus Group 4-8 y.o.: number of participants and personal data

The focus group sessions for the 4-8 age group in Greece involved a total of 8 participating students and were conducted at the 6th Primary School of Gerakas, located in the Municipality of Pallini. Gerakas is a suburb situated in the north-eastern part of Athens, Greece. All of the participating students from the second grade of this primary school were in the same class. The relevant details and data pertaining to these sessions are presented in Table 9 below:

PARTICIPANTS	AGE	GENDER	LOCATION'S POPULATION
Participant_1	**7**	**Female**	30,001–200,000
Participant_2	**8**	**Male**	**30,001–200,000**
Participant_3	**8**	**Male**	**30,001–200,000**
Participant_4	**7**	**Male**	**30,001–200,000**
Participant_5	**8**	**Male**	**30,001–200,000**
Participant_6	**8**	**Female**	**30,001–200,000**

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Participant_7	**8**	**Female**	**30,001–200,000**
Participant_8	**7**	**Female**	**30,001–200,000**

Table 9: Greece Participants (4-8 years old): age, gender and location

Figure 31: Focus group session in Greece

Focus Group 9-13 y.o.: number of participants and personal data

The focus group sessions for the 9-13 age group in Greece involved a total of 11 participating students and were conducted at the 6th Primary School of Gerakas, located in the Municipality of Pallini. Gerakas is a suburb situated in the north-eastern part of Athens, Greece.

All of the participating students from the second grade of this primary school were in the same class. The relevant details and data pertaining to these sessions are presented in Table 10 below:

PARTICIPANTS	AGE	GENDER	LOCATION'S POPULATION
Participant_1	11	**Female**	**30,001–200,000**
Participant_2	**11**	**Female**	**30,001–200,000**
Participant_3	**11**	**Male**	**30,001–200,000**
Participant_4	**10**	**Female**	**30,001–200,000**
Participant_5	**11**	**Female**	**30,001–200,000**
Participant_6	**11**	**Female**	**30,001–200,000**
Participant_7	**10**	**Female**	**30,001–200,000**

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Participant_8	**10**	**Female**	**30,001–200,000**
Participant_9	**11**	**Female**	**30,001–200,000**
Participant_10	**10**	**Female**	**30,001–200,000**
Participant_11	**10**	**Male**	**30,001–200,000**

Table 10: Greece Participants (9-13 years old): age, gender and location

Figure 32. Focus group session in Greece

Focus Group 14-19 y.o.: number of participants and personal data

The focus group sessions for the 14-19 age group in Greece involved a total of 13 participating students and were conducted at the 2nd Secondary School of Gerakas, located in the Municipality of Pallini. Gerakas is a suburb situated in the north-eastern part of Athens, Greece. All of the participating students from the second grade of this primary school were in the same class. The relevant details and data pertaining to these sessions are presented in Table 11 below:

PARTICIPANTS	AGE	GENDER	LOCATION'S POPULATION
Participant_1	**14**	**Female**	**30,001–200,000**
Participant_2	**15**	**Female**	**30,001–200,000**
Participant_3	**15**	**Female**	**30,001–200,000**
Participant_4	**14**	**Female**	**30,001–200,000**
Participant_5	**15**	**Male**	**30,001–200,000**

Participant_6	**15**	**Male**	**30,001–200,000**
Participant_7	**15**	**Male**	**30,001–200,000**
Participant_8	**15**	**Male**	**30,001–200,000**
Participant_9	**14**	**Male**	**30,001–200,000**
Participant_10	**15**	**Female**	**30,001–200,000**
Participant_11	**14**	**Female**	**30,001–200,000**
Participant_12	**14**	**Female**	**30,001–200,000**
Participant_13	**14**	**Male**	**30,001–200,000**

Table 11: Greece Participants (14-19 years old): age, gender and location

6.1.2.3 Pan-European: Participants' description

This section sets out basic information about the teacher participants of the focus group sessions conducted by EUN. This information was collected through initial questions during each focus group session.

Focus groups have been conducted with 29 early-childhood, primary and secondary education teachers from 11 European and 3 South-East Asian countries. Out of 29 teachers, 4 are Early Childhood education teachers, 15 teach in primary and 10 in secondary schools. A more detailed overview of teachers coming from different countries and the level of education in which they teach can be found in the figure below.

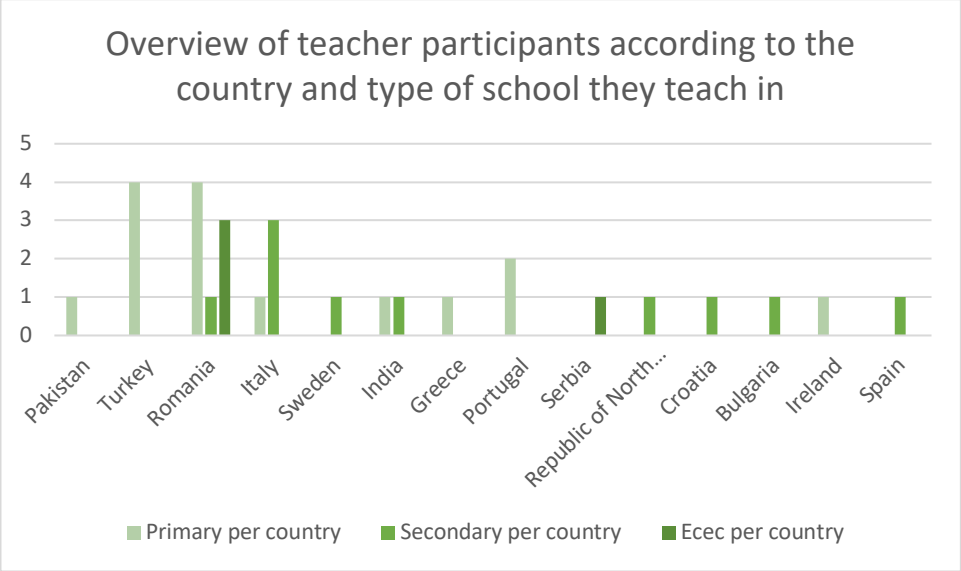

Figure 33. Overview of teacher participants according to the country and type of school they teach in

A total of 847 students participated in class discussions conducted by teachers before the focus group sessions, providing feedback on the proposed educational formats to teach about

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bioeconomy. An overview of teachers and students per country can be found on the table below (see Table 12).

	Country													
	PK	TR	RO	IT	SE	IN	GR	PT	RS	MK	HR	BG	IE	ES
Teachers	1	4	8	4	1	2	1	2	1	1	1	1	1	1
Students	45	119	214	178	23	50	12	25	25	80	20	7	29	20

Table 12: Spread of students and teachers per country

The teachers and students who participated in the focus groups are mainly from urban areas, specifically 20 teachers with 662 students come from urban areas, whilst 7 are coming from rural ones, with 164 students (the information is detailed in the Table 13 below).

	Country													
	PK	TR	RO	IT	SE	IN	GR	PT	RS	MK	HR	BG	IE	ES
Urban	1	3	6	4	1	1	0	0	0	1	1	1	0	1
Rural	0	1	2	0	0	1	1	1	1	0	0	0	1	0

Table 13: Teaching environments of teacher participants

Teachers living in urban areas indicated that the population of the locality in which they teach is mainly more than 200,000 inhabitants (11 out of 20 teachers), with 9 teachers living in smaller, but still urban areas, with a population between 30,001 to 200,000 inhabitants. When it comes to rural areas, 8 teachers teach in smaller rural areas with 5001 to 30,000 inhabitants, with one teacher teaching in a place with the population lower than 5000. One of the queried teachers did not provide this information.

Out of 29 queried teachers, 4 were early childhood education teachers mainly from rural areas in Eastern Europe, specifically 3 out of 4 teachers comes from areas with 5001 to 30,000, whilst one teacher comes from an urban area with 30,001 to 200,000 inhabitants. The 4 teachers conducted class discussions with 83 students between the ages 5 to 8, with an average age of 6.5 years old.

Primary school teachers represented the largest participants' group, with 15 teachers from predominantly urban areas, mainly inhabited by more than 200,000 inhabitants with only 3 teachers from rural areas, inhabited by 5001 to 30,000 and one with less than 5000 inhabitants. Primary school teachers conducted class discussions about the materials with 379 students between the ages of 9 to 13, with an average age of 12 years old.

Lastly, 10 secondary school teachers from only urban areas took part in the focus groups, with 6 teachers living in areas with the population between 30,000 to 200,000 inhabitants. Teachers conducted class discussions implementing the provided materials with 385 students between the ages of 14 to 19, with an average age of 16 years old.

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Personal data of each teacher participant is presented in the table below. The teachers are ordered in the table by the level of education in which they teach, from Early Childhood education to secondary school teachers. The table represents the gender and country of origin of each of participating teacher, as well as the number and age of students that actively participated in the class discussions conducted by the participants. Lastly, the population and environment in which the teachers teach were presented.

Participants	Gender	Country	Number of students	Age of students	Students from same class	Location's population[1]	Environment[2]
Participant_1	Female	Serbia	25	5	Yes	5001-30,000	Rural
Participant_2	Female	Romania	19	6	Yes	30,001-200,000	Urban
Participant_3	Female	Romania	25	7	Yes	5001-30,000	Rural
Participant_4	Female	Romania	14	7-8	Yes	5001-30,000	Rural
Participant_5	Female	Pakistan	45	13-14	Yes	More than 200,000	Urban
Participant_6	Female	Turkey	10	10-11	No	More than 200,000	Urban
Participant_7	Female	Romania	15	12-13	Yes	More than 200,000	Urban
Participant_8	Female	Romania	27	13	Yes	30,001-200,000	Urban
Participant_9	Female	Greece	12	11-12	Yes	5001-30,000	Rural
Participant_10	Female	Romania	22	11	Yes	30,001-200,000	Urban
Participant_11	Female	Portugal	4	9-12	No	5001-30,000	Rural
Participant_12	Female	Italy	40	12	No	30,001-200,000	Urban
Participant_13	Female	Turkey	35	12	Yes	5001-30,000	Rural

[1] Less than 5,000; 5,001–30,000; 30,001–200,000; More than 200,000
[2] Rural, urban

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Participants	Gender	Country	Number of students	Age of students	Students from same class	Location's population[1]	Environment[2]
Participant_14	Female	Romania	25	11-13	No	30,001-200,000	Urban
Participant_15	Male	India	20	12-16	Yes	5001-30,000	Rural
Participant_16	Female	Turkey	24	9-10	No	More than 200,000	Urban
Participant_17	Female	Turkey	50	10-12	No	More than 200,000	Urban
Participant_18	Male	Ireland	29	10-11	No	Less than 5000	Rural
Participant_19	Female	Portugal	21	9-13			
Participant_20	Female	Italy	23	17	Yes	30,001-200,000	Urban
Participant_21	Female	Sweden	23	13	Yes	More than 200,000	Urban
Participant_22	Female	India	30	15	No	More than 200,000	Urban
Participant_23	Female	Italy	45	15-18	No	30,001-200,000	Urban
Participant_24	Male	Republic of North Macedonia	80	15 - 18	No	30,001-200,000	Urban
Participant_25	Female	Croatia	20	16	Yes	30,001-200,000	Urban
Participant_26	Female	Bulgaria	7	14 - 16	Yes	More than 200,000	Urban
Participant_27	Female	Italy	70	14 -15	No	30,001-200,000	Urban
Participant_28	Female	Spain	20	17	No	More than 200,000	Urban
Participant_29	Female	Romania	67	16-17	No	30,001-200,000	Urban

Table 14: Detailed information about teacher participants

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Participants of the online focus groups did not previously know each other. They all work in different schools around Europe and beyond. When it comes to students that participated in the class discussions, on average students were from the same class. However, in cases when the teacher presented the material to more than 30 students, they were from different classes that teachers teach to. In the table above (see Table 14) you can see the detailed overview of number of students and if they belong to the same class.

6.1.3 Focus group development conditions: overview

Each partner (HSPN, EUN & AIJU) has chosen the location of the focus groups according to their availability and possibilities.

Regarding Spain and Greece, the focus groups were carried out in person by GenB Project researchers, in the AIJU Child Lab in the case of Spain, and in educational centres in the case of HSPN.

GenB focus groups on the side of EUN have been performed as a two-step process. EUN launched an international call for teachers. The selected teachers performed classroom discussions with their students according to the materials provided by AIJU and gathered their students' opinion on the proposed Gen B materials. Teachers then shared their students' insights as well as their own views, in heterogeneous online focus groups organised and moderated by EUN. A total of 4 focus groups sessions of 1 hour per session were conducted online, with an average of 7 teacher participants per session.

The following are details of the aspects of the focus groups developed by each of the parties involved.

6.1.3.1 Spain: Technical data

In Spain, sessions were carried out in AIJU's Child Lab, a space equipped with a camera and closed audio circuit, distributed in two rooms: a room for the development of the activities, and a room for live visualisation using a spy mirror and a telecommunications system. All sessions were video recorded with the permission of the participants and their parents or legal guardians, who signed a consent form.

Figure 34: Focus group session in Spain

Table 15 summarises the main information on the conditions under which the focus groups were conducted in Spain.

GENERAL CONDITIONS - SPAIN	
Partner who has implemented the activity	AIJU
Country and place of implementation	Spain, AIJU'S Child Lab
Date and time of the activity	19/04/2023 – 26/04/2023
Duration of the session	90 minutes per session
Students' age group	6-8; 9-13; 14-19

Table 15: General conditions – Spain

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6.1.3.2 Greece: Technical data

The focus group sessions in Greece took place at primary and secondary education schools that are part of the HSPN network of collaborating schools.

Figure 35: Focus group session

To ensure transparency, the sessions were audio recorded with the consent of the parents or legal guardians, who signed a consent form. The sessions were designed to accommodate three different age groups: 4-8, 9-13, and 14-19. Table 16 provides specific contextual details, including the conditions under which the focus group was conducted.

GENERAL CONDITIONS - GREECE	
Partner who has implemented the activity	HSPN
Country and place of implementation	Greece, Athens
Date and time of the activity	8/05/2023 – 26/05/2023
Duration of the session	80 minutes per session
Students' age group	6-8; 9-13; 14-19

Table 16: General conditions - Greece

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6.1.3.3 *Pan- European: Technical Data*

Table 17 below provides brief information on the conditions under which the focus group was conducted, identifying:

GENERAL CONDITIONS – Pan-European	
Partner who has implemented the activity	European Schoolnet (EUN)
Country and place of implementation	Online
Date and time of the activity	12/04 – 28/04
Duration of the session	1h per session
Students' age group	6-8; 9-13; 14-19

Table 17: General conditions – Pan-European

6.1.4 Moderators' details: overview

There are 3 different types of key actors involved in a focus group: the participants, a moderator and an observer.

- PARTICIPANTS: students/teachers of the specific group.
- MODERATOR: person who leads the session, conducts the discussion and raises the questions and issues.
- OBSERVER: the action of moderating requires full attention. For this reason, the focus group requires the presence of another observer who takes note of the ideas that emerge in the group. This person should not intervene in the discussion, but only record the information. For this reason, it is advisable that his or her role should be as unnoticed as possible. To guarantee this aspect, in Spain the focus group took place in special facilities that allow the observer to remain hidden. In the absence of this possibility, the session was recorded (with the permission of the participants and their legal guardians) in order to note down the ideas afterwards.

Occasionally, the same person may take on the role of moderator and observer, so it is advisable to video record the session in order to be able to analyse the details later.

Based on these aspects, the information on the people who acted as moderators in each country is presented below.

6.1.4.1 *Spain: moderator's details*

In Spain, each session was attended by the children of the target group and 3 AIJU technicians: a moderator, a person in charge of the recording and a person who visualised the session and noted down the important aspects, as can be seen in Figure 6.

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Figure 36: Development of one of the focus group sessions at AIJU's facilities

Regarding the moderators, Table 18 summarises the information on the moderation of the focus group with 14-19-year-old students in Spain.

MODERATOR - SPAIN	
Educational level	PhD – master's degree
Profile background (teacher, researcher, etc.)	Researcher
Relationship with the GenB Project	Project Partner
Relationship with the Focus Group participants	None

Table 18: Spain Moderator details

6.1.4.2 Greece: moderator's details

In Greece, each session involved children, a moderator, and an observer responsible for taking notes.

Figure 37: Development of one of the focus group sessions in Greece

Table 19 shows the moderator's details.

MODERATOR - GREECE	
Educational level	Master's Degree
Profile background (teacher, researcher, etc.)	Researcher, with an academic background in Primary school Education
Relationship with the GenB Project	Project Partner
Relationship with the Focus Group participants	None

Table 19: Greece Moderator details

6.1.4.3 Pan-European: moderator's details

On behalf of EUN, focus groups were moderated by EUN Representative, with an additional EUN colleague present as support. In the Table 20 below the professional profile of the moderator, his relationship with the Gen B Project and relationship with the teacher participants is provided.

MODERATOR (PARTNER INVOLVED)	
Educational level	Master's in educational science
Profile background (teacher, researcher, etc.)	Project and Pedagogical officer
Relationship with the GenB Project	Project Partner
Relationship with the Focus Group teacher participants	None

Table 20: EUN Moderator details

6.1.5 Structure and content

The focus groups consisted of two distinct parts:

- Research on the personal interests of the participating students.
- Research on the perceptions of the participating students on the didactic proposals for Bioeconomy education co-created in the Common Ground Camp.

Both aspects are closely related and are key to offering children and young people educational experiences adapted to their interests and characteristics, with the aim of facilitating the acquisition of meaningful learning.

Based on this structure, the actions developed to deepen each of these aspects are described below.

6.1.5.1 Research on the interests of participating students

Children's motivations and interests are constantly evolving along with social changes. AIJU has spent more than 30 years researching childhood and its evolution, following the development of the different factors that influence children's way of being in a global context. In its extensive research, it is evident that, even if children from the same generation share some commonalities, they have specific characteristics that have to be taken into consideration.

Based on this premise, AIJU has developed the CHANGERS methodology, aimed at detecting children's interests through 7 children's social profiles that help define what children are like today.

To obtain these profiles, AIJU carried out different studies in previous projects from a qualitative and a quantitative approach. On a qualitative level, AIJU applied observational analysis methodologies and ethnographic tools, and carried out focus groups and evaluation meetings with experts. It also developed an exhaustive review of the latest international research and publications. On a quantitative level, AIJU carried out a survey with more than 3,500 boys and girls in 5 European countries.

As a result of this research, the following 7 profiles are shown:

CREATIVE HEROES. Playful toy lovers

HUMOROUS CHAMPS. Silly play makers

AFFECTIONATE DREAMERS. Loving princesses and princes

NOTABLE ACHIEVERS. Challenge seekers

GREEN EXPLORERS. Curious outdoor adventurers

EXPERIMENTAL MAKERS. DIY creatives

REMOTE SOCIAL LOVERS. Social media users

Figure 38: CHANGERS children profiles developed by AIJU

Creative Heroes are children who love to play with toys and are very imaginative in the way they play with them. They show little interest in technological, musical and fashion trends.

Humorous Champs are very enthusiastic children who love to play with both toys and video games and enjoy making people laugh very much.

Affectionate Dreamers are children who enjoy playing princesses and taking care of dolls and plush toys very much. They live in a world of fantasy and imagination, and they love dancing.

Notable Achievers love physical or mental challenges and above all they like to win at games, video games or practicing a sport. They like to follow the news (be up to date) and usually belong to an organised team.

Green Explorers are children who love nature and animals. They like sports and playing outdoors. They are very creative and love to play both with and without toys.

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Experimental Makers mainly love reading and doing crafts. They prefer to be at home and are quite sedentary.

Remote Social Lovers are children who love to be up to date in technology and video games. They usually have a mobile phone and a tablet. They are the ones who use social media the most, especially YouTube and TikTok.

Application of "Changers" children social profiles to GenB project

Following this methodology of child profiles, to investigate the interests of the participating students, in the 4-8 and 9-13 age groups, the children were presented with the different CHANGERS profiles, developed by AIJU, with the aim of getting them to identify with one of them (between 1 and 3 profiles) and from there to talk about the activities they like to do.

This information was collected through 2 different procedures. In the 4-8-year-old group, a dynamic was developed in which each child was given banners with profiles. They were encouraged to pick up the one(s) with which they felt most identified, as shown in Figure 9.

Figure 39: Dynamics to find out the interests of the 4-8 age group

For the group of students aged 9-13 years, a shared poster was made, on which the children stuck stickers with their profiles, as shown in Figure 10.

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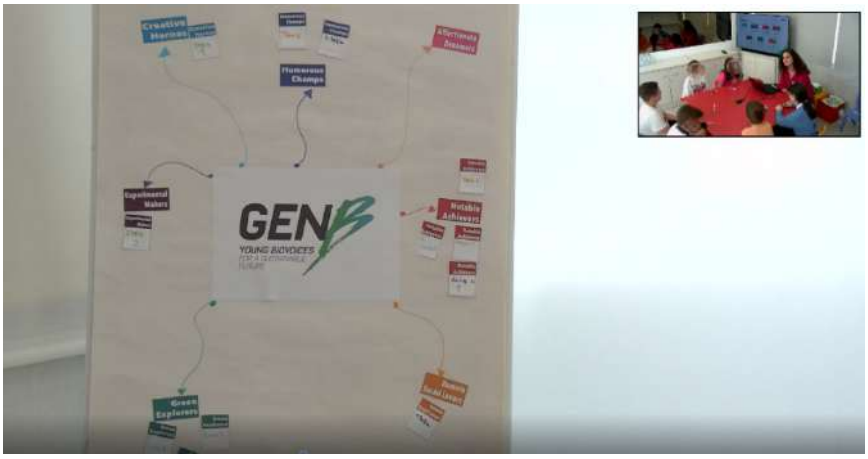

Figure 40: Creation of a poster of interests during a focus group session

Once the process has been clarified, the information regarding participants' interests is synthesised below, in section 3.4.

6.1.5.2 Research on the proposals for Bioeconomy education co-created at the Common Ground Camp

After identifying the participants' interests, their views and preferences regarding the didactic proposals for educating in Bioeconomy co-created in the Common Ground Camp were investigated.

Following the working methodology developed in the Common Ground Camp, in this second phase, specific procedures and materials were developed for each age group, with the aim of adapting the contents to their capacities and characteristics. The following is a brief explanation of the procedure followed in each group.

Educational proposals for students from 4 to 8 years of age

In this age group, the activities were presented on the basis of three different categories: introduction, development and conclusion, with the following structure (see Table 21).

INTRODUCTION	DEVELOPMENT	CONCLUSION
Touch bioeconomy materials	Puppets	Photo exhibition
	Visit to the countryside	
Storytelling	Cooking workshop	Video
	Songs and music	
Group discussion	Games	Fair

Table 21: Structure of the educational proposals for the 4-8 age group

The activities and dynamics used to introduce and validate these proposals are shown in Annex 6.3, which includes the materials created by AIJU to implement the focus groups with students from 4 to 8 years of age.

Educational proposals for students from 9 to 13 years of age

In this age group, once the GenB concept has been introduced, the moderator explains the 10 following proposals shown in Table 22 with the help of the participants.

PROPOSALS FOR STUDENTS 9-13 years of age
Pop-up book
Focus groups
Storytelling
Role-playing
Research project
Posters & diagrams
Games
Experiments: soap making
Workshops
Fair – Market

Table 22: List of educational proposals for the 9-13 age group

After that, the participants rated each of the proposals individually through a gamified dynamic, as can be seen in Figure 41.

Figure 41: Gamified dynamic to evaluate the didactic proposals in the target group 9-13 years old

The specific activities and dynamics used to introduce and validate these proposals are shown in Annex 6.4, which includes the materials created by AIJU to implement the focus groups with students from 9 to 13 years old.

Educational proposals for students from 14 to 19 years of age

In this age group, a total of 17 proposals were presented to the participants, as listed in the Table 23 below:

PROPOSALS FOR STUDENTS 14-19 years of age
Games
Video games / Apps
Fairs / Markets
Social Networking
Citizen science activities
Debates and focus groups
Living Labs and co-creation activities
Hackathon
BioMarathon, competitions and contests
Artistic activities
Podcasts
Field trips
Storytelling
Intergenerational activities
Challenges
Experiments
Recipe book

Table 23: List of educational proposals for the 14-19 age group

Firstly, the participants rated the 5 proposals they liked the most, putting likes on them. As a result, the murals shown in Figure 12 were obtained.

Figure 42: Posters

After that, the participants rated each of the 17 proposals.

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The specific activities and dynamics used to introduce and validate these proposals are shown in Annex 6.5, which includes the materials created by AIJU to implement the focus groups with students from 14 to 19 years of age.

6.2 Results

After detailing the methodological aspects that guided the focus groups, the following sections present a synthesis of the main results that emerged in the sessions, organised according to the following structure:

- Synthesis of the results on the interests of the participating children and young people.
- Synthesis of the results on the evaluation and validation of the didactic proposals to educate in Bioeconomy co-created in the Common Ground Camp of the GenB Project.

In order to obtain a more detailed view of the perceptions and interests of each age group, the results are presented organised according to each of the three groups considered.

For each age group, the overall results are presented first, considering the countries as a whole. This is followed by the individualised information provided by each of the partners involved in the process.

6.2.1 Results on students' interests

As explained in Section 6.1.5.1 above, in order to explore the interests of participants in the 4-8 and 9-13 age groups, a specific approach was employed. The children were introduced to a series of CHANGERS profiles developed by AIJU and encouraged to identify with one or more of these profiles (up to three) as a means of initiating discussions about their preferred activities.

On the other hand, for the 14-19 age group, participants were asked directly about their interests.

Having established the process, the gathered information regarding the participants' interests for each age group is summarised below. First, general information is provided and then disaggregated by country.

6.2.1.1 Students 4-8 years old: general interests and CHANGERS profile description

As far as students aged 4 to 8 years old are concerned, Figure 13 shows an overview of CHANGERS profiles, in which the profiles with the highest presence at this stage are clearly distinguished.

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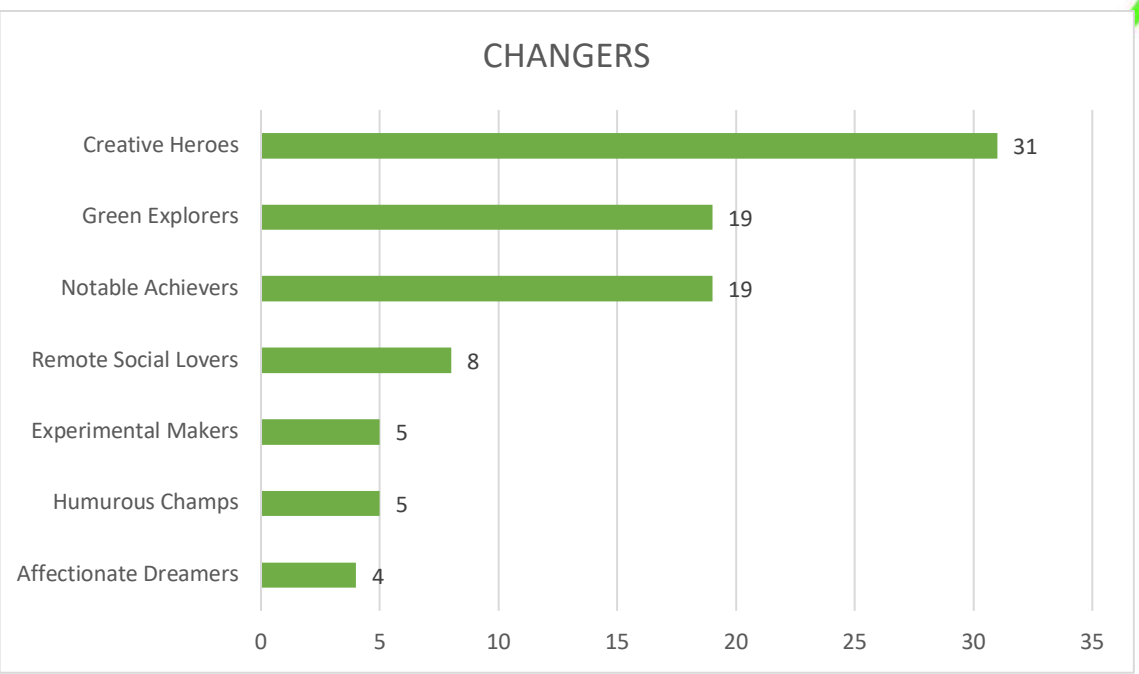

Figure 43: Overview of CHANGER profiles in the group of students from 4 to 8 years old

As can be seen in the figure above, the most chosen profile at this stage is Creative Heroes, followed by Green Explorers and Notable Achievers. It should be noted that in the selection of participants it was considered that they liked nature and were aware of environmental issues, so these results are influenced by these factors. This does not detract from the validity of the research carried out, as it is based on a qualitative approach, which does not seek to be representative (as is the case in the previous research carried out by AIJU from which the profiles are derived), but rather to investigate in depth the motivations of the participants.

These results have important implications for the success of the GenB Project and for moving towards the creation of a more sustainable and just bioeconomy. The importance of this profiles facilitates the process, due to the interests and preferences associated with each of them.

Creative Heroes are children who use their creativity and imagination to achieve their goals. Heroes and heroines are aspirational figures for this type of child, who are interested in bringing about an optimising change in society. They have a strong sense of justice and are committed to social causes, making them a very interesting profile for moving towards the Bioeconomy.

Green Explorers can also actively contribute to moving towards the Bioeconomy, as they are the children who are most interested in nature and the environment. They love doing outdoor activities, and are committed to caring for ecosystems, plants, animals, etc. So learning about the Bioeconomy can engage their attention, as it connects directly with their interests.

Finally, Notable Achievers are children who love challenges and enjoy solving problems. Therefore, if they see the progress towards the Bioeconomy as a challenge to be achieved, they can be significantly engaged.

After these overall results, the information by country is shown below.

Spain: Interests of students of 4-8 y.o.

Table 24 below shows the results on the profiles and interests of the participating 4-8-year-old students in Spain.

PARTICIPANTS	SOCIAL PROFILE[3] (CHANGERS)	INTEREST & MOTIVATIONS
Participant_1	**AD**	She loves princesses, cuddly toys, dolls and playing with her friends.
Participant_2	**GE - EM**	He loves nature and playing outdoors. He enjoys painting and doing crafts and experiments.
Participant_3	**RSL - EM**	She really likes watching YouTube, TikTok and social media. She likes to do handicrafts.
Participant_4	**CH**	She likes superheroes and wants to help the world. She also likes to draw.
Participant_5	**RSL – EM - HC**	He likes to use technology, TikTok, YouTube, etc. He likes arts and crafts, painting and playing Pokémon. He likes jokes.
Participant_6	**AD - GE**	She likes animals. She likes stickers.
Participant_7	**GE - EM**	She loves skating.
Participant_8	**NA**	He likes to play football.
Participant_9	**CH – HC - RSL**	He likes to play Lego. He likes jokes. He likes watching TV. He likes maths and playing umberblocks game.
Participant_10	**NA – RSL - CH**	She likes to win at games and ride her bike. She likes to watch TV. She likes to dress up.

Table 24: Spain - Profile and interests of 4–8-year-old participants

[3] CH: Creative Heroes; HC: Humorous Champs; AD: Affectionate dreamers; NA: Notable achievers; GE: Green explorers; EM: Experimental makers; RSL: Remote social lovers.

Greece: interests of students of 4-8 y.o.

Table 25 outlines the social profiles and interests of students aged 4 to 8.

PARTICIPANTS	SOCIAL PROFILE[4] (CHANGERS)	INTEREST & MOTIVATIONS
Participant_1	**EM**	Likes the outdoors.
Participant_2	**NA**	Likes watching TV.
Participant_3	**RSL**	Likes playing tablet.
Participant_4	**NA**	Likes playing football and tablet.
Participant_5	**HC**	Likes playing football and tablet.
Participant_6	**AD**	Likes playing with her friends and her dolls.
Participant_7	**AD**	Likes planting flowers and learning new things.
Participant_8	**RSL**	Likes sleeping.

Table 25: Greece - Profile and interests of 4 to 8 year-old participants

Pan-European: general interests and CHANGERS profile description

A total of 18 teachers, 15 primary and 3 early childhood education teachers identified the interests of their students and conducted the profiling according to the CHANGERS Methodology.

In the case of early childhood education teachers and students between the ages of 5 to 8, students mainly choose to be Creative Heroes, followed by Notable Achievers and Green Explorers. Teachers indicated that their students choose the role of Creative Heroes because they felt that in this role, they can change the world. Additionally, they mentioned that this role was also chosen as it was the first presented. The role of Notable Achievers was chosen mainly as students linked it to success and being successful in different areas. Teachers indicated that Green Explorers role was chosen as their students enjoy spending time outdoors and exploring their environment. Teachers indicated that none of their students choose the roles of Affectionate Dreamers and Experimental Makers.

[4] CH: Creative Heroes; HC: Humorous Champs; AD: Affectionate dreamers; NA: Notable achievers; GE: Green explorers; EM: Experimental makers; RSL: Remote social lovers.

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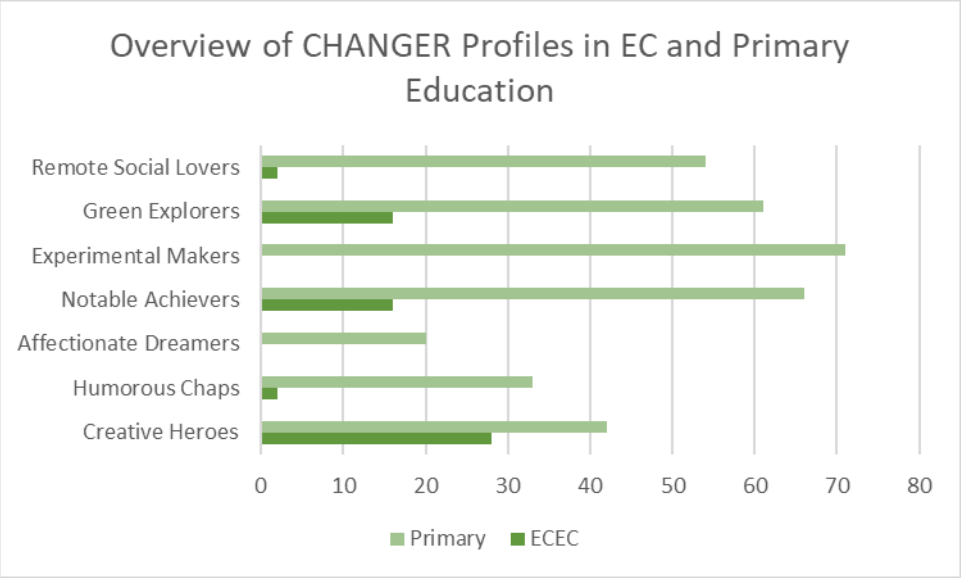
A more thorough overview of role assumptions among EC students can be seen in the figure below (see Figure 14), represented in the intense green colour.



Note: EC (Early Childhood), ECEC (Early Childhood Education Care)

Figure 44. Overview of CHANGERS profiles among EC and Primary school students

Teachers indicated that key words provided with each role facilitated students' choice of profiles, however the images presented were suggestive and clouded the judgement of younger students. They also indicated that this exercise allowed students to reflect on themselves, on what kind of learner and person they are, thus it was hard for some students to take just one role. Moreover, this activity allowed teachers to get to know their students better, their interests and preferences, how they learn and how to provide them with more personalised activities.

In the focus groups with EC and Primary school teachers, that teach students from the ages of 5 to 8 years old and 9 to 13 years old, teachers indicated which CHANGERS profiles the children identify with. An overview of identified profiles with additional information provided by teachers can be found in the table below (see Table 26).

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PARTICIPANTS	NUMBER OF STUDENTS PER PROFILE[5] (CHANGERS)	INTEREST & MOTIVATIONS
Participant_1	**5 CH**	The teacher indicated that their students would like to be superheroes and to help others, they love to play outside and do sports. They would like to be successful, like people depicted in the materials. Moreover, they love outdoors and nature and exploring their environment.
Participant_2	**10 NA**	
	10 GE	
Participant _3	**19 CH**	The teacher shared that their students would like to change the world, and being Creative Hero would allow them to do so. Moreover, they are concerned about environment and ecology.
	6 GE	
Participant _4	**4 CH**	The teacher indicated that NA role was the most attractive to their students as they became aware of different challenges, both physical and mental, that need to overcome to become 'great'. The CH role was connected to their love for superheroes and find them as role models, they would like to save the world. They also enjoy using social media and electronic devices.
	2 HC	
	6 NA	
	2 RSL	
Participant _5	**6 CH**	
	5 NA	
	9 EM	
	5 GE	
	5 RSL	
Participant _6	**1 CH**	
	2 HC	
	3 EM	
	3 GE	
	1 RSL	
Participant _7	**6 CH**	The teacher indicated that their students are very sociable, they enjoy group work and like to take care of animals and nature.
	6 HC	
	4 AD	
	3 EM	
	4 GE	
	4 RSL	
Participant _8	**6 NA**	They like games outdoors, playing in the nature and group activities.
	6 GE	

[5] CH: Creative Heroes; HC: Humorous Champs; AD: Affectionate dreamers; NA: Notable achievers; GE: Green explorers; EM: Experimental makers; RSL: Remote social lovers.

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PARTICIPANTS	NUMBER OF STUDENTS PER PROFILE[5] (CHANGERS)	INTEREST & MOTIVATIONS
	8 RSL	
Participant _9	9 CH	The teacher indicated that their students help people and are active outdoors. They wish to be like superheroes, as the main reason why their students choose CH. When it comes to GE, these students love animals, they all have pets which they love to take care of
	3 GE	
Participant _10	18 EM	These students like cooking activities and workshops, as well as spending time outside.
	4 GE	
Participant _11	4 NA	
Participant _12	6 EM	
	6 GE	
	8 RSL	
Participant _13	5 CH	The teacher indicated that their students are very into social media and video games, so they are quite competitive and like to stay up to date with the new trends. The teacher noted that students with higher grades were more inclined to take the role of EM. GE role was assumed by the least number of students as the teacher states that their students are not very concerned about the environment.
	2 AD	
	9 NA	
	8 EM	
	2 GE	
	9 RSL	
Participant _14	8 CH	They are attracted by doing different experiments, very creative and like to express their creativity
	2 NA	
	13 EM	
Participant _15	4 CH	
	2 NA	
	10 EM	
	4 GE	
Participant _16	2 AD	This teacher works in a science and arts centre; thus, the students enjoy science lessons, they like animals and outdoors, therefore the majority of students oriented around the GE role.
	2 NA	
	5 EM	
	15 GE	
Participant _17	2 CH	
	18 HC	
	2 AD	
	13 NA	
	2 EM	
	9 GE	
	4 RSL	
Participant _18	1 CH	Students are very competitive, they like competing especially in games
	5 AD	
	15 NA	

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PARTICIPANTS	NUMBER OF STUDENTS PER PROFILE[5] (CHANGERS)	INTEREST & MOTIVATIONS
	8 RSL	
Participant _19	7 HC	
	7 NA	
	7 RSL	

Table 26. Overview of CHANGER Profiles among students per each participant

6.2.1.2 Students 9-13 years old: general interests and CHANGERS profile description

As far as students aged 9 to 13 years old are concerned, Figure 15 shows an overview of CHANGERS profiles, in which the profiles with the highest presence at this stage are clearly distinguished.

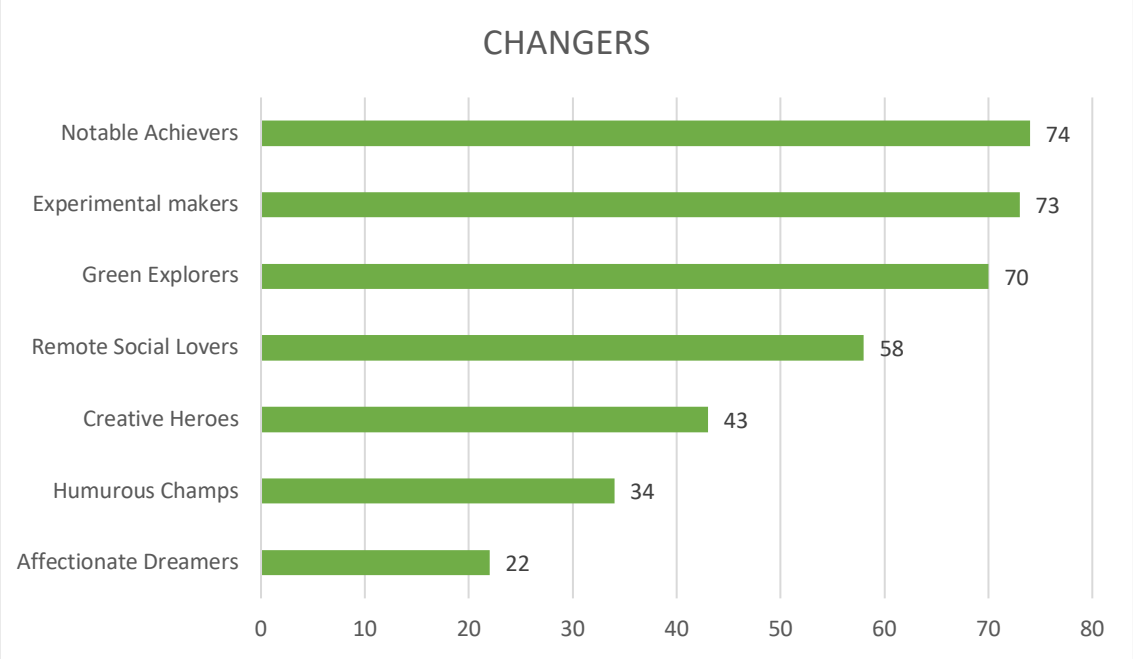

Figure 45: CHANGERS profile description

As can be seen in the figure above, the most chosen profile at this stage is Notable Achievers, followed by Experimental Makers and Green Explorers.

These results are favourable to the implementation and success of the actions developed in the framework of the GenB Project, because learning about the Bioeconomy connects with the interests of the three most numerous profiles at this stage.

Regarding the profile of Notable Achievers, the most numerous in this age group, these are children interested in achieving goals, who love to face challenges and solve problems that put

both their inventiveness and physical skills to the test. In this sense, posing the Bioeconomy as a challenge and proposing related actions can greatly motivate this group of students.

Experimental Makers are interested in conducting experiments and manipulative activities, which allow them to interact with different resources and formats. In this sense, activities related to the Bioeconomy based on experiential learning are an excellent resource.

Finally, Green Explorers are nature-loving, concerned and interested in sustainability and caring for all living creatures, so moving towards a sustainable Bioeconomy is part of their priorities.

After these overall results, the information by country is shown below.

Spain: interests of students of 9-13 y.o.

Table 27 below shows the results on the profiles and interests of the participating 9-13-year-old students in Spain.

PARTICIPANTS	SOCIAL PROFILE[6] (CHANGERS)	INTEREST & MOTIVATIONS
Participant_1	**AD**	She likes singing, dancing and watching TV.
Participant_2	**RSL**	She likes dancing and watching TV.
Participant_3	**RSL**	He likes playing football.
Participant_4	**GE**	He likes nature, playing football and eating hamburgers.
Participant_5	**AD**	She likes laughing, the pink colour and watching YouTube.
Participant_6	**RSL - HC**	She likes to keep up to date with technology. She enjoys making friends laugh. She loves dancing.
Participant_7	**NA - GE**	He loves to win, He enjoys photography and nature.
Participant_8	**NA - HC**	He is very competitive, he loves swimming. He loves jokes.
Participant_9	**CH – EM**	He likes superheroes. He loves handicrafts and go fishing.
Participant_10	**NA – GE**	She is very competitive and she loves to win. She likes animals and nature.
Participant_11	**GE - NA**	She loves nature and drawing.

[6] CH: Creative Heroes; HC: Humorous Champs; AD: Affectionate dreamers; NA: Notable achievers; GE: Green explorers; EM: Experimental makers; RSL: Remote social lovers.

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Table 27: Spain - Profile and interests of 9-13- year- old participants

(1) CH: Creative Heroes; HC: Humorous Champs; AD: Affectionate dreamers; NA: Notable achievers; GE: Green explorers; EM: Experimental makers; RSL: Remote social lovers.

Greece: interests of students of 9-13 y.o.

Table 28 outlines the social profiles and interests of students aged 9 to 13.

PARTICIPANTS	SOCIAL PROFILE[7] (CHANGERS)	INTEREST & MOTIVATIONS
Participant_1	**GE**	Likes going for shopping.
Participant_2	**NA**	Likes gymnastics.
Participant_3	**NA**	Likes sports.
Participant_4	**NA**	Likes gymnastics.
Participant_5	**NA**	Likes dancing.
Participant_6	**EM**	Likes playing the guitar.
Participant_7	**GE**	Likes gymnastics.
Participant_8	**GE**	Likes playing volleyball.
Participant_9	**NA**	Likes having fun.
Participant_10	**GE**	Likes movies.
Participant_11	**GE**	Likes reading encyclopaedias about animals.

Table 28: Greece - Profile and interests of 9 to 13 year-old participants

(1) CH: Creative Heroes; HC: Humorous Champs; AD: Affectionate dreamers; NA: Notable achievers; GE: Green explorers; EM: Experimental makers; RSL: Remote social lovers.

[7] CH: Creative Heroes; HC: Humorous Champs; AD: Affectionate dreamers; NA: Notable achievers; GE: Green explorers; EM: Experimental makers; RSL: Remote social lovers.

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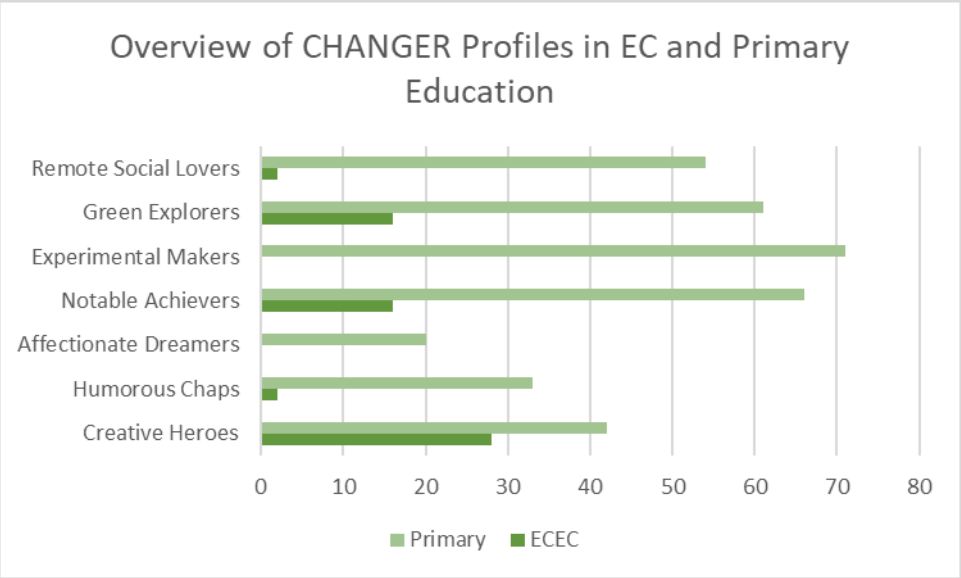
Pan-European: general interests and CHANGERS profile description

Primary school students usually assumed the roles of Experimental Makers, followed by Notable Achievers and Green Explorers. Teachers noted that some students assumed multiple roles, as they were moving from one to another. Students identified with these roles mainly because they enjoyed participating in more active hands-on activities and trying new things. They also indicated that students enjoy taking care of nature and animals, and are becoming more environmentally cautious, as well as aware of climate change and sustainability issues. They indicated that they want to be a part of the solution and work towards more sustainable behaviours.

A more thorough overview of role assumptions among primary school students can be seen in the Figure 46 below, represented in the light green colour.



Note: EC (Early Childhood), ECEC (Early Childhood Education and Care)

Figure 46. Overview of CHANGERS profiles among EC and Primary school students

6.2.1.3 Students 14-19 years old: general interests and CHANGERS profile description

Students in this age group show a wide variety of different interests. It is worth noting that these young people are at an age close to the beginning of adulthood, which is reflected in their interests and preferences, which begin to emulate those of the adult population.

In general, they show a preference for shared activities, which allow them to connect with others. They especially prefer activities where they can spend time with their friends and peer group, as well as meeting new people, exchanging experiences and experiencing time together.

On the one hand, there are interests related to trends and fads that prevail in today's society, such as fashion, digital technologies (both social media and video games, coding and programming, robotics, etc.), or entrepreneurship. These interests, of a strong aspirational

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nature, are combined in some cases, as young people aspire to pursue professions related to these preferences, such as communicator, influencer, programmer, entrepreneur, etc.

Sports are also of great importance at this age, with football, basketball and tennis being particularly popular. Young people like to follow the games, but especially to play these sports, which gives them the possibility to share experiences with their friends and peers. Similar activities are outdoor sports or activities, and those that take place in close contact with nature.

Artistic hobbies such as music, theatre, acting, dance or plastic arts also capture the interest of this age group.

Finally, other notable hobbies are cooking and watching TV series.

Spain: interests of students of 14-19 y.o.

Table 29 below shows the results on the profiles and interests of the participating 14-19-year-old students in Spain.

PARTICIPANTS	INTEREST & MOTIVATIONS
Participant_1	Sports: playing tennis.
Participant_2	Sports: playing football.
Participant_3	Sports: playing basketball.
Participant_4	Sports: playing basketball, go shopping.
Participant_5	Watching series, hanging out with friends.
Participant_6	She likes to help people.
Participant_7	He likes psychology and loves fashion.
Participant_8	She loves geography and theology.
Participant_9	She likes dancing.
Participant_10	He likes playing video games.

Table 29: Spain - Interests of 14 to 19 year-old participants

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Greece: interests of students of 14-19 y.o.

Table 30 presents the information obtained from the participants during the focus group session. The data included in the table is derived from their interests and primarily extracted from the interactive presentation titled "One thing about me."

PARTICIPANTS	INTEREST & MOTIVATIONS
Participant_1	Art and painting, with a focus on landscapes and abstract art.
Participant_2	Cooking and experimenting with different recipes and flavours.
Participant_3	Theatre and acting.
Participant_4	Social media and fashion.
Participant_5	Entrepreneurship and business, aspiring to start their own company.
Participant_6	Technology and gaming.
Participant_7	Science and technology, particularly coding.
Participant_8	Music (playing the piano).
Participant_9	Gaming, with a preference for strategy and role-playing games.
Participant_10	Adventure and outdoor exploration, enjoying activities like hiking and camping.
Participant_11	Social media and fashion.
Participant_12	Dance, specialising in hip-hop and contemporary styles.
Participant_13	Sports (particularly basketball) and outdoor activities.

Table 30: Greece - Interests of 14 to 19 year-old participants

6.2.2 Results on the proposals' validation

Once the information on the interests and preferences of the participating students has been presented, the results on the validation of the educational proposals to educate in Bioeconomy co-created in the Common Ground Camp of the GenB Project are shown below.

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Following the same structure as in the previous section, the results are presented by age group. Within each group, the overall results are presented first, followed by individual partner results.

6.2.2.1 Results on the proposal's validation for the 4-8 age group

Regarding the perceptions of students aged 4 to 8 years old on the activities co-created for their age group, Table 31 below shows an overview of the results at a general level, covering all participating countries.

It should be noted that the table only shows the results of students who rated these activities in terms of "Likes" or "Dislikes". In addition to these data, there is a percentage of children who showed a neutral opinion of the activities by rating them as "neither like nor dislike".

TYPE OF PROPOSALS		Nº LIKES	Nº DISLIKES
INTRODUCTION PROPOSALS	**Storytelling**	**45/101**	**5/101**
	Group discussion	**38/101**	**4/101**
	Touch bioeconomy materials	**32/101**	**21/101**
DEVELOPMENT PROPOSALS	**Visit to the countryside**	**68/101**	**2/101**
	Games	**57/101**	**2/101**
	Cooking workshop	**52/101**	**7/101**
	Songs and music	**36/101**	**9/101**
	Puppets	**20/101**	**8/101**
CONCLUDING PROPOSALS	**Fair**	**44/101**	**2/101**
	Photo exhibition	**27/101**	**5/101**
	Video	**25/101**	**3/101**

Table 31: Results on the proposal's validation for the 4-8 age group

As can be seen in Table 31, all the proposals receive positive reactions from the students, as the number of likes far exceeds the number of dislikes.

The interpretation of these results should be complemented with the interpretation offered in section 4.2. of the conclusions, since while this section shows the pupils' general assessments of

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the different activities, section 4.2. shows their preferences, since the children were asked to choose which of these activities were their favourites.

In addition to evaluating these activities, the children also formulated proposals that are of interest to them for learning about the Bioeconomy, which are summarised below:

- Camping: they think it would be very interesting to go camping in the garden or in the countryside, in order to learn, tell stories, play games about nature, etc.
- Create a mini garden in the classroom or at home: to plant plants, learn how they grow and bloom, see different types, etc.
- Workshops: plant seeds with cotton wool and see how they grow.
- They propose to combine the field trip with storytelling or puppets, performing a play about Bioeconomy and care for the environment in natural surroundings. They suggest that the puppets could interact with the space, and they would learn more to love nature. They also say they would like to do a play in costume, being the actors themselves.

Spain: Synthesis of results of the focus group with 4-8-year-old students

At the beginning, none of the participants know what the Bioeconomy is. After some initial dynamics supported by the pop-up book "What is Bioeconomy?" from the BIOVOICES Project, as shown in Figure 47. all participants understand what bioeconomy is and find it an interesting concept.

Figure 47: Initial dynamics on Bioeconomy concepts through the book "What is the Bioeconomy?"

The children are very curious to learn more about the Bioeconomy. They love to discover the life cycle of biomass and are very surprised by the examples of bio-based products, which is reflected in their facial expressions, as can be seen in Figure 48.

Figure 48: Children's reactions to discovering the Bioeconomy

Table 32 summarises the results of the introductory activities.

INTRODUCTION ACTIVITIES			
PROPOSAL	**Nº LIKES**	**Nº DISLIKES**	**COMMENTS**
Touch bioeconomy materials	**8/10**	**2/10**	The activity captures their attention, and they find it attractive. They state that they would really like to touch and smell the bio-based products and discover what things can be made with them. They also explain that they would like to experiment with these materials, and that they love to discover new things and see how they feel through their senses.
Storytelling	**8/10**	**2/10**	They find story-making and story-listening a very interesting activity[8]. Participants say that they like the activity because they like reading very much. They value accompanying the stories that are created or read with pictures and images, because they find it very attractive. Discovering new learning through new words and pictures is engaging. One child states that they like listening to stories more than reading them, because they associate reading with school activities (homework), which has a negative component for them.

[8] In this age group, creativity and imagination are highly valued skills, so storytelling is an excellent teaching tool. It should be noted that this is a target group that is starting or consolidating the process of reading and writing, so activities that involve telling, creating or reading stories are mental challenges for them that stimulate their learning and curiosity, and help them to surpass themselves.

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Group discussion	8/10	2/10	It is a proposal that generates a lot of interest for them. They feel that they can learn a lot from it, and that they can share their knowledge with other people (learn from others and learn together). They see the proposal as an aspirational activity, typical of adults, which pleases them and motivates them to participate. The brakes that are detected are related to the possible tension that can be generated by having different opinions. They also perceive that the activity may involve talking for a while or that they may be asked a question that is difficult to answer.

Table 32: Introduction activities

The results of the development activities are shown in Table 33 below.

DEVELOPMENT ACTIVITIES			
PROPOSAL	**Nº LIKES**	**Nº DISLIKES**	**COMMENTS**
Visit to the countryside	10/10	0/10	They like to be outdoors and do activities in nature. This gives them the opportunity to observe different plants, animals and atmospheric phenomena. They think it is a very fun and attractive way to learn new things. They also relate it to the concept of research. As proposals they mention: group games, hiking, seeing rare plants and flowers, seeing how flowers bloom and learning about it, picking flowers or fruits, planting plants or trees. Two participants point out the frustration of being told that they are going to see certain animals and then not being able to see them.
Games	9/10	1/10	They like playing games very much, so they find this proposal very attractive. They like the idea of playing games that are new to them too. They emphasise that they prefer shared games, where they can interact with their friends. They value more games in nature and outdoors. As for the theme of the games, they point out that games about nature and saving the planet are interesting.
Cooking workshop	8/10	2/10	Most of the participants find it interesting and think that it can help them to learn. They think that cooking is fun, especially if it is done in the company of friends or parents. Tasting what they collect and cook is interesting for them. Two participants explain that they find the proposal fun, but that they prefer other types of activities because

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			they are not good at cooking, and sometimes the result of the recipe does not turn out well.
Puppets	**7/10**	**3/10**	They explain that they love puppets and would really like to learn about Bioeconomy with puppets. They think puppets are a fun way to learn stories. A non-hand puppet format would be more attractive to them. As a suggestion, they really like the puppets of animal characters, and they think they are suitable for learning about caring for nature. They also like to create their own stories themselves, using the puppets. However, three participants point out that puppets "are too small" and boring.
Songs and music	**4/10**	**6/10**	In general, they like to sing and find songs a good resource, especially when accompanied by dances. However, some of them prefer another type of activity, because they are a bit embarrassed to dance or sing in public. Also because the song can be boring.

Table 33: Development activities

Finally, as far as the proposals for concluding activities are concerned, they are the ones that generate the most interest among the participating children. All three proposals get a high number of likes, and their excitement is reflected in their faces, as can be seen in Figure 49.

Figure 49: Reactions of the participating children to the concluding activities

Table 34 summarises the results of the participants' assessments and reflections on the concluding activities.

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CONCLUDING ACTIVITIES			
PROPOSAL	**Nº LIKES**	**Nº DISLIKES**	**COMMENTS**
Photo exhibition	**9/10**	**1/10**	Taking photos seems very attractive to them, and it is an aspirational activity, which they associate with adults and successful young people such as models, influencers and celebrities. They say that they have been dreaming of taking photos since they were young and that they also love nature. Therefore, it is an activity that combines two things they love: photography and nature.
Video	**9/10**	**1/10**	They like watching videos a lot, especially on YouTube, also on TikTok. They watch cartoon videos, funny videos, scary videos, videos of videogames, etc. That is why they would really like to learn about Bioeconomy through videos. Although several of them argue that their parents do not let them spend much time watching videos.
Fair	**8/10**	**2/10**	They find it very interesting to prepare and organise a fair showcasing bio-based products. They would like both to visit it and to participate in activities organised at the fair such as: workshops, experiments, etc.

Table 34: Concluding activities

Greece: Synthesis of results of the focus group with 4-8-year-old students

Below are presented three summary tables of the results obtained in the group of 4-8-year-old students in the focus groups in Greece.

INTRODUCTION ACTIVITIES			
PROPOSAL	**Nº LIKES**	**Nº DISLIKES**	**COMMENTS**
Group discussion	**6/8**	**2/8**	During the discussion students shared their perspectives on working individually versus working in groups. One student expressed a preference for working independently, stating that they feel more comfortable and productive when they can focus on their own tasks and ideas without the influence or input of others. Another student pointed out the potential issue of uneven participation within small groups. They observed that some group members may contribute less compared to others who take on more significant roles and make larger contributions. This student implied that individual efforts might be more reliable and effective than relying on the collective work of a group.

			Similarly, another student expressed a preference for individual work during regular lessons, suggesting that group work should be reserved for more light-hearted or playful activities. They indicated that they find personal productivity and concentration more achievable when working alone. However, it is important to note that students recognised the value of group discussions and collaboration. They emphasised the opportunity to collaborate with classmates, listen to different perspectives, and ultimately form opinions that consider the viewpoints of all students. A student also highlighted the benefits of sharing personal items, working as a group, and learning from others' experiences.
Storytelling	**5/8**	**3/8**	The students expressed a general fondness for reading stories, particularly those cantered around mythology. They appreciated the imaginative aspect of books, which allowed them to explore new worlds and characters. One student specifically mentioned their enjoyment not only of listening to stories but also of telling stories themselves. They found the entire process of storytelling to be exciting and engaging. Additionally, another student highlighted the happiness that comes from having others read their own stories, emphasising the sense of accomplishment and the opportunity to improve spelling skills through writing. However, it was important to note that not all students shared the same enthusiasm for writing stories. One student mentioned a preference for reading rather than writing, indicating a personal inclination towards consuming stories rather than creating them. Another student emphasised that individual preferences play a role, acknowledging that not everyone may enjoy the same stories or storytelling activities.
Touch bioeconomy materials	**3/8**	**5/8**	The students expressed mixed feelings about this sensory exploration. On one hand, they mentioned the potential dislike for unfamiliar tastes or smells associated with these materials or raw materials. However, they also acknowledged the excitement that comes with exploring the unknown and the possibility of discovering something they might enjoy. Some students expressed an overall positive attitude towards the activity, appreciating the opportunity to engage with bioeconomy materials. However, they also highlighted the potential for the activity to become monotonous or lose its appeal over time. It was evident that their interest and enthusiasm were dependent on

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			the novelty and variety of the materials and experiences offered. Interestingly, one student specifically mentioned their love for nature, indicating a strong motivation to participate in activities related to its protection. This student's affinity for the natural world drove their eagerness to try anything associated with the preservation and conservation of the environment.

Table 35: Introduction activities

DEVELOPMENT ACTIVITIES			
PROPOSAL	**Nº LIKES**	**Nº DISLIKES**	**COMMENTS**
Cooking workshop	**8/8**	**0/8**	During the discussion on cooking workshops, all the students expressed their positive views and enthusiasm for this activity. They unanimously mentioned that they liked participating in cooking workshops for two main reasons. Firstly, students appreciated the opportunity to cook dishes that they personally enjoy. They found it exciting to have a hands-on experience in the kitchen and create food items that cater to their preferences. This aspect of personalisation and choice allowed them to engage actively and take pride in preparing meals or treats according to their own tastes. Additionally, the students described cooking workshops as an exciting activity in general. They expressed their enjoyment in learning new cooking techniques, exploring different ingredients, and being involved in the process of creating something delicious. The hands-on nature of cooking workshops provided a dynamic and interactive learning environment that captured their interest and made the experience enjoyable.
Games	**7/8**	**1/8**	Students unanimously agreed that they enjoy playing games as it allows them to have fun while acquiring knowledge and skills. They mentioned that games create an engaging and interactive learning environment, making the learning process more enjoyable and memorable. Through games, students felt actively involved and motivated to participate, which enhanced their overall learning experience. However, one student expressed a specific preference regarding board games, mentioning that they find them less appealing due to their longer duration. This student

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			seemed to prefer games with shorter playtimes, potentially indicating a personal preference for more dynamic and fast-paced activities.
Visit to the countryside	**6/8**	**2/8**	During the discussion on visits to the countryside, students shared their experiences and perspectives. One student mentioned that they often visit the countryside with their parents, and as a result, they find it boring when they go to the same places with the school. This student's comment suggests that familiarity with the location diminishes their excitement or interest in visiting those specific places during school trips. On the other hand, in general, students expressed their positive views about going to the countryside and found it interesting. These students appreciate the opportunity to explore natural environments, engage with different aspects of rural life, and learn from first-hand experiences outside the classroom. The countryside offers unique sights, sounds, and experiences that captivate their curiosity and make the visits enjoyable and educational.
Songs and music	**5/8**	**3/8**	Some students mentioned feeling hesitant or afraid of being critiqued if they do not sing well. They expressed concerns about potential judgment or negative feedback from others. Additionally, some students mentioned feeling shy or self-conscious about singing in front of their peers or an audience. These concerns reflected their personal reservations and fears about their musical abilities. However, despite these concerns, students emphasised that they genuinely enjoy music and find it to be a fun activity. They expressed their appreciation for the joy and entertainment that music brings. The students acknowledged the positive and engaging nature of music, recognising its ability to uplift spirits and create a lively atmosphere.
Puppets	**3/8**	**5/8**	Students expressed various opinions and feelings towards this activity. One student stated that they perceive puppets as a "girly" activity, which they indicated as the reason for it not being appealing to them. This student's comment suggests that they associate puppets with a specific gender stereotype, which influences their level of interest. Another student simply described puppets as boring, implying a lack of engagement or excitement associated with this activity. This perspective suggests that the student may not find puppets interesting or enjoyable compared to other activities.

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			Additionally, a student mentioned the possibility of shyness as a factor that might deter them from preferring this activity. It appears that this student feels hesitant or uncomfortable with the idea of using puppets, possibly due to the need to perform or interact with others in a more public manner. It is important to acknowledge that these viewpoints represent the perspectives of individual students and are not universally shared among all students.

Table 36: Development activities

CONCLUDING ACTIVITIES			
PROPOSAL	**Nº LIKES**	**Nº DISLIKES**	**COMMENTS**
Fair	**8/8**	**0/8**	Students mentioned that they enjoyed participating in fairs because it provided them with an opportunity to create things and sell them. They appreciated the sense of ownership and accomplishment that came with creating items to sell at fairs. They found joy in the process of designing and making their products, and they felt a sense of pride in presenting their creations to others. Furthermore, students mentioned that fairs provided a lively and engaging environment. They enjoyed the festive atmosphere, interacting with other participants, and exploring the variety of products and activities available. Fairs offered them a chance to socialise, learn from others, and appreciate the talents and skills of their peers.
Video	**6/8**	**2/8**	Students expressed their interest and enthusiasm for both creating and consuming video content. They found the idea of creating videos appealing, as it allowed them to express their creativity and share their ideas in a visually engaging manner. Additionally, students mentioned their enjoyment of watching videos. They expressed a desire to consume video content as a means of entertainment, learning, and gaining new knowledge. They appreciated the visual and audio elements of videos, which made the learning process more engaging and enjoyable for them.
Photo exhibition	**4/8**	**4/8**	A student expressed his fear of appearing on the internet, indicating concerns about privacy and online visibility. This fear might be attributed to a lack of

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			understanding or previous negative experiences related to online presence. However, despite these concerns, students conveyed their overall appreciation for photos and expressed a genuine interest in participating in photo exhibitions. They recognised the value and beauty of visual storytelling and acknowledged the potential enjoyment and learning that can come from engaging with photographs.

Table 37: Concluding activities

Pan-European: Synthesis of results of the focus group with teacher participants teaching 4-8-year-old students

In the tables below aggregated results obtained from 83 EC students results per dimension are shown. Activities that make up each block are addressed individually, quantifying the results obtained for each of them in terms of 'I like', 'I neither like nor dislike', and 'I do not like'. Qualitative information is also provided in an aggregated way for each of the activities, summarising the reasons for such assessment of the activity. In some cases, queried teachers did not mention the number of dislikes, however they would clarify why their students did not choose the activity. An overview of likes and dislikes of the activities, as well as the rationale behind specific choice can be seen in the table below (see Table 38).

INTRODUCTION ACTIVITIES			
PROPOSAL	**Nº LIKES**	**Nº DISLIKES**	**COMMENTS**
Storytelling	32	-	Teachers indicated that this type of activity is very appealing to students as it captures their attention and imagination. Additionally, it is a common tool used in EC education, thus they are familiar and comfortable with the format.
Group discussion	24	-	One teacher noted that when voting among Introduction activities students choose this format as their favourite but were indifferent when voting for their overall favourite activity. Other teacher indicated that their students were not very interested in group discussions as this is their usual practice in the classroom.
Touch bioeconomy materials	21	14	Teachers indicated that students enjoy exploring natural materials and become familiar with new smells and feelings. However, they indicated that this is a messy activity, thus many students were reluctant to choose it. Remaining students were indifferent towards the activity.

Table 38: Introduction activities

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When it comes to introductory activities storytelling was the most appealing format for students, as it is a commonly used tool in early childhood education. It requires imagination and listening and allows filling in the story with their own insights.

DEVELOPMENT ACTIVITIES			
PROPOSAL	**Nº LIKES**	**Nº DISLIKES**	**COMMENTS**
Visit to the countryside	52	-	Teachers indicated that students enjoy experiences that happen outside of schools, experimental learning connected to the real world. However, they also indicated that the images included in the material affected students' judgement. One of the teachers indicated that this was interesting choice as they live in the rural area.
Games	41	-	Games allow students to collaborate, challenge and compete. They indicated that they would prefer more outdoor and group games rather than online. The remaining students did not select this activity showing indifference, without specifying if they dislike it.
Cooking workshop	36	5	One of the teachers indicated that their students were very interested in this activity as in their school students are not allowed around the kitchen, and they would be interested in the process. Other teacher indicated that they would be interested in even creating small dishes that do not require proper kitchen.
Songs and music	27	-	As this is one of the common practices in ECE students showed less interest towards this activity. They did indicate they would like to learn songs about bioeconomy and climate change. The remaining students were indifferent towards the activity.
Puppets	10	-	One teacher indicated that students like engaging with puppets, whilst 3 did not mention this activity as the activity of their students' choice.

Table 39: Development activities

When it comes to development activities, most students choose 'Visits to countryside' as a most appealing activity format. Based on the discussion with teachers and the reasoning students provided during class discussions, students enjoy field trips and experimental learning that takes place outside of classrooms. It allows them to be more active and curious and more engaged in the learning situation.

CONCLUDING ACTIVITIES			
PROPOSAL	**Nº LIKES**	**Nº DISLIKES**	**COMMENTS**
Photo exhibition	14	-	When choosing solely among concluding activities, this was the first choice among students of one teacher, whilst the other indicated that students were not very interested in this activity as it is something they already do often.
Video	10	-	Students marked that making videos is something they are already familiar with; it allows them to express themselves creatively and share their ideas in a more compact and funny way.
Fair	28	-	Students indicated that fairs are enjoyable activities for them, as they have the chance to interact with all the students in school and share their talents and ideas with them.

Table 40: Concluding activities

Students mainly choose fairs as the most appealing format as they have experience with fairs in their schools, as they take place around every major holiday in their countries. Teachers explained that during these events students have a chance to practice a vast variety of skills, as well as showcase their talents and what they produced in class. The fairs foster relations with the community and parents.

6.2.2.2 Results on the proposal's validation for the 9-13 age group

Regarding the perceptions of students aged 9 to 13 years old on the activities co-created for their age group, Table 41 below shows an overview of the results at a general level, covering all participating countries.

It should be noted that the table only shows the results of students who rated these activities in terms of "Likes" or "Dislikes". In addition to these data, there is a percentage of children who showed a neutral opinion of the activities by rating them as "neither like nor dislike".

PROPOSAL	Nº LIKES	Nº DISLIKES
Games	**209/401**	**22/401**
Role-playing	**141/401**	**16/401**
Experiments: soap making	**119/401**	**21/401**

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Workshops	**92/401**	**17/401**
Research Project	**84/401**	**16/401**
Debates & Focus groups	**66/401**	**19/401**
Fair - Market	**65/401**	**6/401**
Posters & Diagrams	**62/401**	**27/401**
Pop-up books	**45/401**	**52/401**
Storytelling	**40/401**	**18/401**

Table 41: Results on the proposal's validation for the 9-13 age group

As can be seen in Table 41, almost all the proposals receive positive reactions from the students, as the number of likes far exceeds the number of dislikes.

Pop-up books are the only proposal that gets more dislikes than likes. This is due to the fact that most of the participants consider it to be a childish proposal, aimed at younger children, which is why it provokes a certain type of rejection in them.

Clearly, the proposal that stands out the most and receives the most interest from participants is games. Children of this age reject activities conceived as more academic and, on the contrary, prefer gamified and playful approaches that allow them to learn while they play and have fun.

The conclusions on this age group are given in section 4.3., where further information is provided.

In addition to evaluating these activities, the children also formulated proposals that are of interest to them for learning about the Bioeconomy, which are summarised below:

- Use social media: videos, outreach campaigns, challenges.
- Demonstrations and public rallies: to give visibility to issues.
- Video games: on bioeconomy issues, with challenges and rewards. Artistic shows and performances: combining drama, dance and singing to capture the attention and interest of society.

Spain: Synthesis of results of the focus group with 9-13-year-old students

The first idea they link to the name GenB is nature and with the concept of "bio". Participant 4 provides the example of organic bags in supermarkets. However, when trying to explain the concept of economy, participants are not clear about its definition. Participant 2 describes it as "the best you're going to get, some bar charts." In conclusion, it can be said that the concept of economy is a term difficult to understand and explain by the participant target.

Regarding the proposals' validation, the students provided the information summarised in Table 42.

PROPOSALS 9-13 y.o.			
PROPOSAL	**Nº LIKES**	**Nº DISLIKES**	**COMMENTS**
Fair - Market	**10/11**	**1/11**	**Strengths:** The fair is a proposal that generates a lot of interest among participants. The value identified in this idea is that it focuses on offering products that are good for sustainability and the environment, and not on mindless consumerism. The possibility of raising money to donate is also identified as attractive. They also emphasise that the fair would be a meeting and socialising point, which would be an opportunity for shared learning and interesting experiences. **Weaknesses:** One participant identifies the brake on generating conflict during the activity. **Proposals**: It is suggested that the lessons that can be learned at the fair should be experiential: "not just learning through words, but through movement, with practical examples and activities". They emphasise that they would love to be able to see things, touch them and experiment with them. In addition, they believe that it would be very interesting to have workshops at the fair that would allow them to see how products are created, and workshops in which different products could be generated from the same biomass element.
Debates & Focus groups	**9/11**	**2/11**	**Strengths:** Three participants say that it is a way for everyone to share their opinions. They find the idea of being asked their opinion and being able to learn from others and their knowledge appealing. The idea of talking to people and coming to an agreement is appealing. **Weaknesses:** Two participants comment that debates can create conflict if, at the end of the debate, there is a winner and a loser. They add that they can become an uncomfortable and tense situation. The usefulness of debates is also questioned: "they serve no purpose". **Proposals**:

			One participant points out that they would like the idea more if it was done online, so that they could use technology to communicate with other discussion partners.
Research Project	**9/11**	**2/11**	**Strengths:** The concept of mystery and research is very interesting and fun for most of the participants. It allows them to discover new things, to investigate using technologies (Google), to get to know other points of view and to learn new things. **Weaknesses:** However, it should be noted that one participant identifies the possibility of not finding what you want and the fear of not knowing how to search well as a brake. In addition, two participants said that they find searching for information boring, and prefer other more "active" proposals. **Proposals**: They prefer collaborative projects, where research is done in teams.
Posters & Diagrams	**9/11**	**2/11**	**Strengths:** It is a tool to express individual creativity in different ways (writing, drawing, painting) and to put imagination into practice. One participant notes that "the motivational phrases that are included (in the posters and diagrams) can be an inspirational tool". It is also attractive to be able to work as a team and incorporate everyone's ideas. Some participants point out that in order to create the poster, it is necessary to search for information beforehand, and this process can be very interesting and allow them to learn new things. **Weaknesses:** However, one participant points to the fact that this activity requires a lot of writing as a constraint. For another, the obstacle lies in the search for information. Another participant questions the real impact that posters can have at a social level. He thinks that for the students who create them, they can be interesting and can help them learn. But he does not think that people will pay attention to the information on the posters, so he does not see much point in them, as they lose their objective, which is to create social awareness of the topic. **Proposals**:

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			They think that is very important to look for attractive images, which capture people's attention, in order to be more effective. One participant points out that more mass activities, such as demonstrations or group demands, would be more effective.
Games	9/11	2/11	**Strengths:** Participants find the idea of gamified learning fun, perceiving it as a more attractive and motivating tool than learning by studying, because of the entertainment it generates. One of the participants points out that "it's a way to have fun studying" and another explains "studying in this way is much easier and much more fun". They highlight as interesting the time limit that Kahoot has when it comes to answering questions. Other positive points that stand out are the fact of forming teams (to be with your classmates and work together) and competing with others, which acts as a motivating factor. **Weaknesses:** One participant rejects the idea, as he does not like the ICT games.
Pop-up books	7/11	4/11	**Strengths:** It is a book format that is perceived as fun and attractive given the 3D drawings it contains. They point out the importance of combining images with text, not just images; otherwise, they consider it too childish. **Weaknesses:** Some of them find it a book format for children of a smaller target group. In addition, they point out that it is a book format that can be easily broken and takes up a lot of space. **Proposals**: As a proposal, they explain that it would be interesting if on the first page of the book there was an envelope with characters, and that you could play and tell stories with them in the different scenarios presented on the pages.
Experiments: soap making	7/11	4/11	**Strengths:** They find the mixtures and reactions fun and love them. Experiments can be done with things that can be reused and they believe that this can be very positive for the environment and for changing their habits. They emphasise that they like to put themselves in the situation of "scientists", to go to the laboratory, to try new things, etc. They also value the importance of

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			experiential learning as more meaningful and lasting learning. **Weaknesses:** The brakes that are identified are related to: - Fear of failure, that the experiment will not succeed. Alternatively, that the result of the experiment is not useful and you end up generating waste. - Feelings of frustration. Perception that the result does not meet expectations. - Bad smell and fear of messing up during the experiment, being scolded and having to clean up a lot. - Perception of a complicated, messy activity, leading to mistakes.
Workshops	**7/11**	**4/11**	**Strengths:** The group work, the interaction with others and being able to integrate everyone's ideas into a project is the main attraction of this proposal. In general, they consider it an entertaining and attractive proposal. **Weaknesses:** They highlight as a barrier the conflicts that can arise between peers when they do not agree with each other. In addition, one participant explains that she prefers other types of activities that allow a more "real" approach, such as excursions.
Storytelling	**6/11**	**5/11**	**Strengths:** They consider that stories can be endearing and fun. Creativity and imagination play an important role in this aspect. Two participants point out that they like the act of telling stories. In general, they find it a more interesting alternative to a conventional class. **Weaknesses:** Two participants say that this learning tool is boring, and another adds that he finds it childish, he likes it better to have the information explained to him or to explain it as it is. Another participant explains that the fact that the story can be "scary" is repulsive to him. **Proposals**: They like listening to stories rather than creating them themselves. They stress the importance of fun stories, with a touch of humour. In addition, that in the case of bioeconomy stories it is important to know a lot about the topic they are talking about.
Role-playing	**6/11**	**5/11**	**Strengths:**

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			Some participants find it an attractive proposition because of the idea of bringing the stories they make up and write into action and making them real, especially the younger ones in the group. The older ones like the idea of watching plays. And the younger ones find both the acting activity (making plays) and role-playing (playing at being an actor/actress) appealing. **Weaknesses:** Two participants expressed the fact that theatre activities can become boring as an obstacle to the activity. The older participants in the group do not see it as such an attractive proposition. While they may be interested in watching theatre, they are not interested in performing theatre themselves, either because they feel embarrassed or because they find it boring to memorise the scripts. **Proposals**: One participant suggests as an improvement the approach of circus activities, as he feels attracted by the concepts of daring and risk that underlie this artistic proposal. Another one suggests to do artistic performances in general, combining drama, dance, singing, etc.

Table 42: Proposals for 9-13- year- old students

Greece: Synthesis of results of the focus group with 9-13-year-old students

In this section, are presented the findings gathered from the opinions of students aged 9-13-year-old in Greece.

PROPOSALS 9-13 y.o.			
PROPOSAL	**№ LIKES**	**№ DISLIKES**	**COMMENTS**
Games	**11/11**	**0/11**	Students expressed enthusiasm for the idea of learning through games, finding it to be an exciting activity. They specifically highlighted that games provide an opportunity to have fun, especially when compared to subjects they may find boring. Students also appreciated the social aspect of playing games with friends, as it allows them to combine learning with enjoyable interactions. One student also noted that the interactive nature of games allows them to participate actively in the learning process, making it more enjoyable and memorable. Furthermore, a student highlighted that the

			satisfaction of solving challenging tasks or overcoming obstacles during complex problems or puzzles contributes to the excitement and sense of accomplishment.
Fair - Market	**11/11**	**0/11**	Fairs and markets can be exciting activities as they provide a platform for students to showcase their creativity skills while also contributing to a good cause. Students mainly highlighted that: Fairs and markets allow them to unleash their creativity by showcasing their handmade goods. Students expressed their excitement about being able to share their unique creations with others, highlighting the joy they derived from the artistic process and the satisfaction of seeing their work appreciated. The aspect that resonated deeply with students was the ability to contribute to a good cause. They appreciated the idea that their participation in fairs and markets could make a positive impact on the community by donating a portion or all of their earnings for a good cause.
Role-playing	**9/11**	**2/11**	Students found role-playing activities interesting because they allow them to step into the shoes of a different character and see the world from that character's point of view. This immersive experience of trying to understand and portray another person's perspective is seen as intellectually stimulating and captivating. A student expressed that even if they are assigned a role they may not particularly like, they still find it intriguing to embrace and embody that role. The challenge of stepping out of their comfort zone and taking on a different character is part of what makes role-playing activities engaging and interesting for them. Furthermore, a student mentioned a general affinity for acting and theatre, indicating that role-playing activities align with their interests. The element of fun and the chance to collaborate with friends further enhance their enjoyment of the experience. Another student pointed out that it is fascinating to witness their friends embody characters different from their usual selves. This adds an extra layer of interest and excitement to the activity, as they get to observe their peers' unique interpretations and transformations. It fosters a sense of discovery and novelty among students. Finally, students appreciated that role-playing games do not require them to memorise information or lines, reducing the fear of making mistakes. This aspect is seen as positive, allowing them to explore and experiment without the pressure of

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			perfection. Initially, there may be some embarrassment, but as they become more familiar with the activity, it becomes easier and more comfortable. On the other hand, some students found role-playing activities boring. They expressed a lack of interest or enjoyment in assuming different roles and feel embarrassed or uncomfortable putting themselves out there.
Research Project	**9/11**	**2/11**	Students expressed that research projects are interesting as they provide an opportunity to learn about various topics, especially when conducting research involving questionnaires or surveys. They appreciate the ability to gather information and gain insights into different aspects of people's lives or specific subjects. The process of exploring and uncovering new knowledge through research is seen as intellectually stimulating and engaging for students. However, some students expressed a lack of interest in research projects, indicating a preference for alternative activities that they find more engaging or enjoyable. It is important to note that this feedback reflects individual preferences, as students may have different inclinations and may not find research projects as appealing as other activities that align with their personal interests.
Pop-up books	**8/11**	**3/11**	Students expressed that pop-up books are seen as a creative activity. They appreciate the intricate designs and craftsmanship involved in creating three-dimensional elements that spring to life as they turn the pages. The interactive nature of pop-up books allows students to actively engage with the story, making the reading experience more exciting and immersive. In addition, students find pop-up books intriguing and engaging due to their multidimensional nature. The ability of these books to incorporate various visual elements, such as pop-up characters, scenery, or objects, captures students' attention and piques their curiosity. The surprises that unfold with each page turn contribute to the overall enjoyment and sense of wonderment. However, it is worth noting that two students expressed a preference for books without images. These students indicated a personal inclination toward books that rely solely on written text, perhaps valuing the power of imagination in constructing mental images based on the words alone.

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Experiments: soap making	8/11	3/11	Students generally welcomed the opportunity to engage in soap-making experiments. Nonetheless, it is important to acknowledge that individual student preferences may vary, with some finding the activity less interesting or engaging compared to their initial expectations. In particular, students expressed a liking for this activity as they can create customised gifts or products for personal use. They emphasised the importance of being aware of the ingredients used, as it provides them with knowledge about what goes into the soap they make and subsequently use. Students also mentioned a sense of pride in their accomplishment when successfully creating the soaps. However, it is worth noting that one or two students commented that the activity is boring, despite acknowledging its initial appeal. This suggests that while the idea of soap-making experiments is intriguing, some students may not find the actual process as engaging or enjoyable as they initially anticipated.
Storytelling	7/11	4/11	Students expressed that they enjoy creating their own stories because it allows them to express their imagination and creativity. The process of crafting characters, settings, and plotlines provides an outlet for self-expression and the opportunity to bring their ideas to life. Students also mentioned that creating stories can be a learning experience. Through storytelling, they may explore new ideas, develop their writing skills, or gain insights into different perspectives. This aspect of personal growth and acquiring knowledge adds to the appeal of creating stories. Furthermore, students find creating stories to be a relaxing activity. It offers a break from academic pressures and allows them to engage in a leisurely and enjoyable pursuit. The freedom to delve into their own imaginative world brings a sense of pleasure and satisfaction. One student mentioned that writing and telling stories are perceived as a waste of time. This perspective suggests that the student may not see value in creative writing activities or may prioritise other activities that they deem more productive or meaningful. Another student mentioned their shyness as a barrier to engaging in storytelling activities. This individual may feel uncomfortable or find it challenging to share their creative work or express themselves openly. The self-consciousness associated with shyness can create

			obstacles to fully enjoying or participating in storytelling activities.
Posters & Diagrams	**5/11**	**6/11**	Students perceived creating posters and diagrams as a collaborative activity that offers the opportunity to work in groups, which they find highly enriching. Additionally, one student mentioned that this activity allows them to make something known within the school community, such as a poster displayed in the school corridor. By doing so, they can effectively reach a larger audience of fellow students. Moreover, students recognise that posters can also be incorporated into the school newspaper, making it a fun activity for those already involved in the newspaper creation process. Students, however, expressed that they find the development process of creating posters and diagrams somewhat boring or less interesting compared to other activities. It is important to note that their feedback does not imply despising the activity, but rather a preference for alternative activities that they may find more engaging or enjoyable.
Debates & Focus groups	**4/11**	**7/11**	Students who find debates interesting expressed that debates help them develop skills such as making arguments, critical thinking, and effective communication. They recognise the practical value of these skills, as they can be applied in various academic subjects and help them excel in their school classes. The opportunity to practice and refine these skills through debates is seen as a valuable and engaging aspect of the activity. One student mentioned enjoying debates because it allows them to think from the other side of an argument. Engaging in debates offers the chance to explore different viewpoints and develop empathy by understanding alternative perspectives. This aspect of broadening their understanding and considering diverse opinions adds to the interest and intellectual stimulation of debates. Another student highlighted the thrill of trying to persuade classmates to think differently during debates. The challenge of presenting compelling arguments and influencing others' perspectives adds an element of excitement and engagement to the activity. However, the majority of students expressed finding debates boring and indicated a preference for other activities. They may not find the format or content of debates as interesting or engaging compared to alternative options that align more closely with their personal preferences. One student mentioned a reluctance to make a case for an argument they don't

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			believe in themselves. This suggests that students may feel uncomfortable or disinterested when required to argue for a position they do not personally endorse.
Workshops	3/11	8/11	The majority of students said that they don't particularly enjoy workshops. It seems that the overall sentiment is a lack of interest or enthusiasm for this type of activity. These students may prefer alternative options or activities that resonate more with their individual preferences. One student specifically mentioned a preference for buying things rather than engaging in workshops to learn how to make things from scratch. This suggests a preference for convenience or a desire to simply acquire the desired items without investing time and effort into the creative process. Conversely, one student mentioned enjoying the creative aspect of workshops and the opportunity to make things on their own. This individual likely finds value in the hands-on experience, the process of learning new skills, and the satisfaction of creating something tangible.

Table 43: Proposals for 9-13-year-old students

Pan-European: Synthesis of results of the focus group with teacher participants teaching 9-13-year-old students

In this section are presented the main findings of the results obtained in the group of 9 -13-year-old students in the focus groups carried out by EUN.

PROPOSALS 9-13 y.o.			
PROPOSAL	**Nº LIKES**	**Nº DISLIKES**	**COMMENTS**
Games	189	20	Students consider games as an effective way of learning. They love creating, developing and playing games. Games allow them to collaborate, learn in a more imaginative way, explore ideas, and express themselves, as well as challenge and compete. They also emphasised that they like outdoor games and would like to have these options of activities. Students who disliked the activity indicated that they don't consider games as an effective way of learning as they become too entertaining.
Role-playing	126	9	Students often choose this activity as it allows them to assume different roles and to imagine and experience the world from different perspectives. Teachers

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PROPOSALS 9-13 y.o.			
PROPOSAL	Nº LIKES	Nº DISLIKES	COMMENTS
			indicated that this activity allows them to reflect on themselves, their opinions and learn from each other.
Experiments: soap making	104	14	Students indicated that they like this activity as it is a hands-on type of activity, that allows them to be active, to manipulate outcomes, learn by doing, collaborate with each other.
Workshops	82	5	Students find this activity beneficial as it allows collaboration and hands-on approach, Participant 18 indicated that, students often collaborate and invite external speakers to share their talents and expertise, this way students are able to meet new people and learn about real-life use of different skills and knowledge they acquire in schools.
Research Project	66	12	Students indicated that these types of activities are appealing to them as they enjoy online research, discovering new information and idea. It allows them to be more active and in charge of the learning process, they are not passive listeners but active in search for correct information. Students who disliked the activity indicated that they find it too complicated and passive.
Debates & Focus groups	53	10	Debates were very appealing to students as allows them to express themselves freely, learn to argument their thoughts and listen to each other. It allows them to learn about new topics and ideas. However, students who disliked this format, consider it very long and exhaustive.
Posters & Diagrams	48	19	Students who are more artistic expressed interest in this activity, finding it a creative and more visual way to share a message, using different digital tools. Students who disliked the format indicated that they found it too complicated.
Fair - Market	44	5	Students indicated that fairs foster entrepreneurial spirit, allow practicing communication and computational skills, and allow students to interact with each other, share their ideas and talents.
Pop-up books	30	45	Majority of teachers, especially those teaching students over 10 years old, indicated that their students have noted that they did not like or choose pop-up books as they considered them more suitable for younger students. Students of Participant_18 noted that this format is not very imaginative, does not allow

PROPOSALS 9-13 y.o.			
PROPOSAL	**Nº LIKES**	**Nº DISLIKES**	**COMMENTS**
			manipulation or experimentation with it. It is a finished piece of information that does not provide continuity or possibility for updating. In the case of the students who did like this format, they were younger students or did not have a lot of experience using this format.
Storytelling	27	7	Students who liked this format are usually more creative students that prefer reading or writing activities, they found it as an imaginative way to express themselves. Students who disliked this activity indicated that it is more suitable for younger students, it is a passive and non-engaging format, moreover they indicated that they do not like reading or writing.

Table 44: Proposals for 9-13-year- old students

6.2.2.3 *Results on the proposals' validation for the 14-19 age group*

Regarding the perceptions of students aged 14 to 19 years old on the activities co-created for their age group, Table 45 below shows an overview of the results at a general level, covering all participating countries.

It should be noted that the table only shows the results of students who rated these activities in terms of "Likes" or "Dislikes". In addition to these data, there is a percentage of children who showed a neutral opinion of the activities by rating them as "neither like nor dislike".

PROPOSAL	Nº LIKES	Nº DISLIKES
Field trips	**174/408**	**7/408**
Challenges	**163/408**	**3/408**
Games	**160/408**	**1/408**
Podcasts	**152/408**	**10/408**
Video games / Apps	**141/408**	**22/408**
Experiments	**138/408**	**6/408**
Debates & focus groups	**133/408**	**17/408**
Social media	**126/408**	**29/408**
Storytelling	**120/408**	**27/408**
Living Labs & co-creation activities	**118/408**	**3/408**
Fairs / markets	**102/408**	**13/408**
Artistic activities	**93/408**	**7/408**
Citizen science activities	**84/408**	**4/408**
BioMarathon, competitions & contests	**66/408**	**18/408**
Intergenerational activities	**61/408**	**9/408**
Recipe book	**52/408**	**13/408**
Hackathon	**49/408**	**7/408**

Table 45: Results on the proposals' validation for the 14-19-years-old age group

As can be seen in Table 45, all the proposals receive positive reactions from the students, as the number of likes far exceeds the number of dislikes.

The interpretation of these results should be complemented with the interpretation offered in section 4.4. of the conclusions, since while this section shows the pupils' general assessments of the different activities, section 4.4. shows their preferences, since the children were asked to choose which of these activities were their favourites.

Spain: Synthesis of results of the focus group with 14-19-year-old students

Regarding the group of students aged 14 to 19 years old, the first idea they link to the name **GenB** is genetics. But when they are told that the term "Gen" refers to "Generation", they think that the "B" stands for "Biodegradable". Finally, when it is specified that it is "Generation Bioeconomy" they suggest that the concept is related to biodegradability, recycling, that it helps the economy or is related to the circular economy and that it does not harm the environment.

When they are asked about **Bioeconomy** and bio-based materials they are familiar with, they mention biodegradable plastic, cardboard, biodegradable packaging and the bamboo toothbrush.

When the concept is explained to them, they are given several examples of bio-based products, their reaction is positive, and they consider the Bioeconomy as a priority objective. These reactions can be seen in Figure 50.

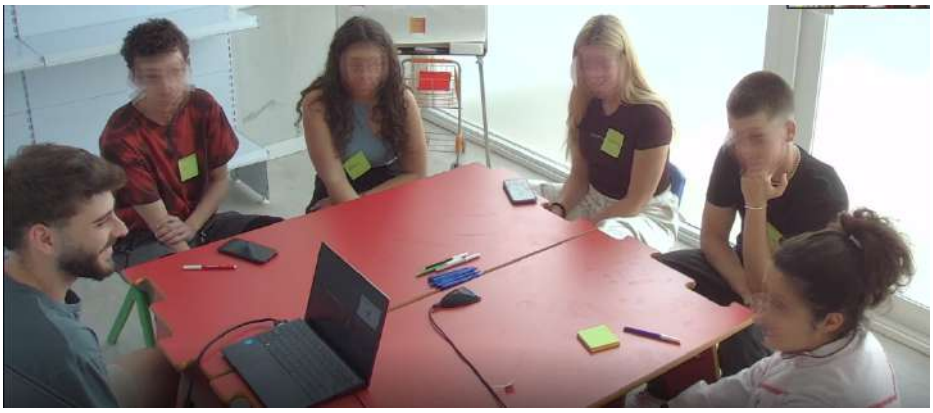

Figure 50: Youngsters' reaction on discovering Bioeconomy

Regarding the GenB Project's Instagram account BIOVOICES, none of the participants know it. Related to this, as far as social networks are concerned, the participants state that they mainly use Instagram. On this network, they follow influencers who talk about their lives and everyday topics, as well as singers and celebrities. In addition, they also consume content related to sports (best matches, best goals, etc.) and from their friends. On this network, they prefer to view images and videos. Secondly, they also mention the use of TikTok for watching videos.

Finally, regarding the pedagogical proposals for educating young people of their age in Bioeconomy, the results are summarised below.

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PROPOSAL	Nº LIKES	COMMENTS
Social media	8/10	**Strengths:** Along with the experiments, it is the proposal that has received the highest number of likes, because it arouses a high level of interest among young people. Participants point out that the networks can be a good resource for learning new things. For example, to learn how to give a second life to products you no longer use, or to become aware of organic alternatives for everyday products. They also point out that social media are powerful tools that can reach many people quickly and easily. So they are good tools to share something you do, a topic or a project with many people. They emphasise that if you create content about the bioeconomy and disseminate it through social media, it can have a far-reaching impact. Focusing on their age group, they believe that social networks are popular and that everyone is using them nowadays. **Weaknesses:** They highlight the difficulty for an influencer on the Bioeconomy to catch their attention. However, if a famous or liked influencer talked about the Bioeconomy, they would get their attention. some participants (2) also point out that influencers can be a controversial figure, because they are only motivated by getting likes. **Proposals**: As proposals on topics or ideas for educating on the Bioeconomy through social networks, they point out the possibility of making recipes with leftovers, as they believe that recipes are very interesting for young people of their age, and that many are encouraged to try those that appear on TikTok. They also point to the power of influencers, so it would be appropriate for them to create content on the Bioeconomy and integrate it into their daily lives, telling experiences and stories from their real lives, because that is what most captures the attention of people their age, and allows them to learn things in a lighter and more interesting way. They also believe that bio-based products could be given more visibility if influencers promoted them, acting as ambassadors. Since people would know more about these products, it would be like advertisements, but more personalised, with more capacity to reach the person, due to the emotional link that is woven with the influencers. Another possibility they propose is to carry out mini-surveys or small competitions through the networks, with content on the Bioeconomy.

		They believe that a good influencer or creator of content on bioeconomy should: offer simple and curious tips, create striking and original content, different from others. They also point to the need to use humour, look for things that people find funny, and create chains of challenges where people are encouraged to take action or simply like a photo to make it go viral.
Experiments	8/10	**Strengths:** Together with social networks, this is the proposal that has received the highest number of likes. It is an activity that arouses their curiosity and in which they maintain a state of expectation, because they never know what might happen, and whether they will manage to complete the experiment or not. They believe that it is a more fun and enjoyable way of learning and working on content and concepts. They emphasise that active and manipulative learning is more meaningful than theoretical learning. They especially like experiments that are more visually striking, or with surprising results. They relate it both to curricular learning and to social networks such as TikTok, being interesting in both formats. **Proposals:** As proposals for experiments to learn about Bioeconomy, they propose trying to create some kind of simple bio-based product.
Recipe book	6/10	**Strengths:** This proposal has generated a lot of interest among the participants. They think that cooking is a topic of interest for today's young people, especially thanks to the help of social networks and TikTok, where many recipes go viral and where challenges about making recipes go viral. In addition, they consider that, being a book of straight recipes with leftovers, they will be more original proposals, with ingredients that you can easily have at home. They also believe that cooking with leftovers can be very satisfying, as you are not wasting food, which means you are helping to avoid damaging the environment (by not generating waste) and saving on the domestic economy (by making better use of resources), especially in the current period of inflation. For this reason, they believe it is a very practical solution, as well as an educational proposal. **Proposals:**

		As a recipe proposal for making use of leftovers, they propose making chips from potato skins. They also point out that these recipes could address other aspects of the Bioeconomy, such as, for example, using boiled water to water plants after allowing it to cool. Or using fruit skins to make compost. They think it would be very interesting to create a book in which professional chefs or especially celebrities famous for their recipes and passion for food, or influencers who share their favourite recipes, would collaborate as authors; with "normal" people such as young people of their age. As this would attract people's attention, and would unite the expert and "gourmet" perspective with the homemade and amateur perspective. And they think it would be a very interesting proposition.
Field trips	**5/10**	**Strengths:** All participants find the field trips a very attractive proposition for young people of their age. **Weaknesses:** However, most of them question its real depth and educational potential, as they claim that this activity is well received because it allows students to "get away" from the classroom, but that they focus more on interacting with friends and living the experience than on the curricular content or learning about the topic or place they are visiting. They believe that the learning that can take place at such events can be "collateral" and of lesser durability. In fact, they say that when it comes to excursions they do not care or worry about the place to visit, they simply want to get out of class and would go on any kind of excursion, regardless of whether they like the subject or not. **Proposals:** They explain that, in any case, if the excursion is to be meaningful, it should be complemented with pre and post activities, and with some element of evaluation previously known to the students, so that they are more attentive and proactive towards learning, because they are going to be evaluated on it. The highest target indicates that it is especially interesting to take the youngest students to these activities. To learn about Bioeconomy, they suggest going on excursions to factories that work with biomass or create bio-based products, to natural landscapes, and going on outings to clean the beaches or the mountains of waste.
Games	**4/10**	**Strengths:** Most of the participants consider that young people of their age are interested in gamified learning, especially through digital games. They

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		say that it is a fun and motivating approach and that they are always excited in class when they do these kinds of activities, and that they even ask teachers to learn through these dynamics. They also add that they find it a more entertaining and up-to-date learning option than textbooks. Therefore, they believe that it can be very useful for teaching Bioeconomy and working on the concept with children of their age. **Weaknesses:** However, it should be noted that some participants (2) also point out that it is a resource that is currently overused. As a result, it no longer generates the interest they had at the beginning, because they have seen it too much. In addition, some participants indicate that it is fine as a learning method for school, but as a playful activity about a topic that might interest them, it is not going to capture their attention. **Proposals**: As digital games that interest them, they mention: Kahoot and Booklet. As topics to work on Bioeconomy through games, they suggest recycling and the life cycle of products, or showing images of biomass and thinking about what can be created with it.
Fairs / markets	**4/10**	**Strengths:** They consider that the fair is an attractive proposal and that it allows to communicate and show bio-based products in an easy and pleasant way, as well as to promote the Bioeconomy. They believe that the fairs can attract a large audience, not only students and their families, but also the general public. In addition, they say that the fair can be combined with other proposed activities such as art or recipes. Ideas for vintage or second-hand clothes stalls at the fair and food stalls made from other food waste are spontaneously emerging. **Proposals**: The participants point out that in order for the fair to achieve its objective and achieve high participation and attendance, it should be located in a visible and frequented place, which makes it easy for passers-by to come across it and decide to visit it. They also believe that it would be very interesting for the fair to have a programme of workshops, where attendees could participate in activities to create the products that are sold or displayed there. In this way, the activity would not only allow the dissemination and promotion of the Bioeconomy, but also education in Bioeconomy, based on learning by doing and experiential learning. They think it would be a good idea to offer workshops for children of their age, as

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		well as for children and adults, so that the students themselves lead these workshops, reinforcing the contents.
Living Labs & co-creation activities	2/10	**Strengths:** They highlight the potential of face-to-face interaction, which allows for a more direct and personal relationship than digital interaction. They emphasise that sharing an experience can be positive and conducive to learning. **Weaknesses:** Other participants comment that they prefer something more entertaining that does not remind them of classroom dynamics, teaching.
Artistic activities	2/10	**Strengths:** Particularly noteworthy in this proposal is the power of dramatization (theatre) and emerging art forms, such as making art from waste. **Weaknesses:** On the other hand, classical arts such as painting, sculpture or music do not seem to be as attractive to people of their age group, at least in their traditional format. If we want to seek the impact and motivation of the target group, they consider it necessary to think of new formulas. In the case of songs, they would not feel comfortable singing or creating songs, although if a famous singer of their interest created a song with Bioeconomy content, they would listen to it. However, they point out that people their age listen to music looking for emotion and sensations and not content, so it does not seem to them to be a good teaching tool for their age group. **Proposals:** As proposals to educate in Bioeconomy they propose: to take advantage of local festivals or artistic events to make sculptures in schools, reusing resources. **In this proposal, a conversation about fashion is spontaneously generated from a comment about the clothes worn by artists, which if they were recycled or second-hand and they informed them about it, would capture their attention and which leads to the great interest in fashion in this age range, where they explain the current interest in second-hand clothes or in taking advantage of clothes that you are no longer going to use to make a new garment.*
Podcasts	2/10	**Strengths:** Although some participants are not familiar with or do not usually listen to podcasts, they all find it an interesting way to learn.

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		Moreover, they emphasise that it is an activity they can do in their free time, and that it can be combined with other tasks, such as tidying their room, playing sport, etc. So it is a practical proposal. They find listening to podcasts much more interesting than listening to the radio; they see podcasts as more current, dynamic and entertaining. They like podcasts on specific topics, also those in which celebrities are invited or people are interviewed. They use podcasts to listen to in the background while studying or doing other work. They give the example of The Wild Project and Nude Project, two very famous podcasts in Spain in which the guests are experts in very diverse fields, which in many cases they would not be interested in, but which they like to appear in this format. This exemplifies the importance of the communicator/influencer for them. **Proposals:** As a proposal for podcasts on Bioeconomy, they consider that it would be interesting to make a podcast in which young people of their age are interviewed, or in which several young people can interact and talk about their experiences and knowledge of the Bioeconomy. They also point out that it would be necessary to add a touch of humour, with jokes or challenges that would relax the subject and show it as something interesting, as well as appearing in a space that they consider to be a reference.
Challenges	**2/10**	**Strengths:** They see it as a dynamic and attractive proposition for young people their age, who are very familiar with the challenges that are shared and go viral on social networks, and often try them out. They also believe that achieving the challenge and surpassing themselves can encourage them, because they can feel better about themselves and be valued by society. **Proposals:** As challenges to promote Bioeconomy, they propose: A BioMarathon, cleaning beaches, searching for bio-based products, etc. They also relate the challenges to fashion, doing challenges by uploading an outfit with clothes from when your father/mother was the age you are now. This shows that if they are interested in the subject and detach it from purely curricular learning, they are much more attracted to it.
Video games / Apps	**1/10**	**Strengths:** Video games do not awaken much interest among this age group, only one of the participants (boy) indicates that he likes to play video

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		games in his free time, and that he would find it interesting to learn through this resource. **Weaknesses:** However, the rest do not consider it an interesting proposal for their age group, because they like to disassociate their leisure time with learning, so that before a video game on the subject attracted their attention, they should already like the subject as such. Regarding their experiences with the didactic use of video games, some participants explain that they have worked with them in class (2), but that they do not find them as interesting as other proposals. Furthermore, they talk about the complexity of making a good video game involving a series of complex and costly processes (programmers, designers, need for advanced technologies for its use, etc.) and consider that this may clash with the concept of Bioeconomy. **Proposals**: They consider that, although video games cannot generate as much interest, following gamified strategies can motivate and engage students. For example, assigning challenges, overcoming levels, offering rewards, etc. An interesting video game on Bioeconomy should have levels, rewards in the form of coins or cheques, etc. And it should also allow interaction with other players, to play with friends. As a topic, they propose a market scenario in which the player must obtain biobased products, discriminate between biobased and non-biobased products, etc.
Debates & focus groups	**1/10**	**Strengths:** One of the participants points out that it can be very attractive to talk and interact with people of the same age in an event that allows you to learn new things in a dynamic way. It is an interesting dynamic, both in terms of meeting new people and new topics. **Weaknesses:** However, they point out that other proposals are more interesting and can attract more attention to young people of their age, as well as achieve a wider reach. Another participant, of a shy nature, points out that it is an activity in which some people will not contribute much. The participant argues that this type of activity may not be attractive to certain types of personalities. Other threats expressed by the participant are the lack of knowledge of how to carry out this activity or the difficulty of certain people to express themselves. On the other hand, other formulas are suitable and useful for any type of person.

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		Proposals: They emphasise the importance of making these activities playful so that they do not give them the feeling that they are at school/college/university learning about a subject out of obligation. As topics for organising debates and focus groups on the Bioeconomy, they propose: the reuse of products, recycling and the management of waste and biomass.
Storytelling	**1/10**	**Strengths:** They consider that storytelling can be a more effective teaching tool for other younger age groups, but it does not generate as much interest among them because they consider it a childish approach. **Weaknesses:** Some participants like to listen to stories, but not to tell them. They feel that sharing stories is a more private activity, which they would share only with their friends, and in informal anecdotal format, without delving into serious or deep issues. **Proposals:** They point out that they should be informal and short stories, and offered in digital format, such as videos on TikTok.
Inter-generational activities	**1/10**	**Strengths:** Although they find other proposals more interesting, in general they believe that intergenerational activities can be a good tool for learning. They highlight the potential of sharing experience and learning from others. They are also interested in the theme of being able to see the evolution of life and society, and to compare the present with the past. Furthermore, they say that it can be very interesting to establish meeting points and links and to be able to make agreements on the basis of this. It is also a way of putting oneself in the other person's shoes and getting to know their interests and needs. Most of them show a preference for the grandparents' generation, as opposed to the parents' generation. Because they believe that this allows them to appreciate changes more easily and to learn together from the past and the present. Also because they are curious about the past. In addition, they connect more emotionally with the elderly than with their parents. **Proposals:** They think that in this type of activities it is better to have the families themselves, because of the emotional bond that is established.

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Citizen science activities	0/10	**Weaknesses:** All participants agree that the other proposals are more interesting than the citizen science activities. They believe that the appeal to science is a brake, even if it is in cooperation with others. The scientific character makes the proposal be seen as a serious subject, which is not motivating, in which they will not have fun, or for which they will not have enough knowledge and skills. They believe that it is a more specific activity, and that it requires a certain degree of knowledge. In addition, they consider that the scope is narrower than in previous cases.
Hackathon	0/10	**Strengths:** In general terms, they consider that it can be an interesting proposal to learn about Bioeconomy. **Weaknesses:** However, they think that other proposals may be more attractive and motivating for people of their age.
BioMarathon competitions & contests	0/10	**Strengths:** Although they find other proposals more interesting, they emphasise that competitions can be attractive, especially for people who are more competitive, like contests, challenges, etc. They believe that participating in events of this type can facilitate learning and generate fun. They find it interesting to organise gymkhanas or activities in which teams can participate, especially during class time, but not as a leisure activity that arises out of self-interest. **Proposals:** As proposals for competitions to educate on the Bioeconomy, they propose: finding ways to reuse objects or products, identifying bio-based products or managing waste.

Table 46: Proposals for 14-19-years-old students

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Greece: Synthesis of results of the focus group with 14-19-year-old students

In this section, we present the findings gathered from the opinions of students aged 14-19 years old in Greece.

PROPOSALS 14-19 y.o.			
PROPOSAL	**Nº LIKES**	**Nº DISLIKES**	**COMMENTS**
Games	**12/13**	**1/13**	Interest and Fun: Students find games like Kahoot and Mentimeter to be interesting activities that also bring an element of fun to the learning process. The gamified nature of these platforms engages students and adds an enjoyable aspect to their educational experience. Collaboration and Interactivity: Students appreciate that these games provide a collaborative and interactive learning environment. Working together as a group enhances engagement and makes the experience more enjoyable and interactive, fostering a sense of camaraderie among students. Alternative to Traditional Lessons: Students value the fact that using games like Kahoot and Mentimeter offers a break from traditional lessons. The interactive and dynamic nature of these games provides a refreshing change of pace, making the learning experience more engaging and enjoyable. Ease of Learning: Students acknowledge that games can be an easy and convenient way to learn. These platforms provide a user-friendly interface and make the learning process more accessible, even for students who may not typically enjoy studying. The gamified approach facilitates the acquisition of knowledge in a more relaxed and enjoyable manner. Personal Preference and Boredom: One student expressed personal preference for finding Kahoot boring, suggesting that individual taste plays a role in whether these games are appealing. Additionally, the perception that these games resemble tests may contribute to feelings of monotony or disinterest, particularly if students do not know the answers or if the novelty wears off over time.
Fairs / markets	**12/13**	**1/13**	Learning Opportunities: Students believe that fairs and markets provide valuable learning opportunities.

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			Specifically, they mention that these events could showcase alternatives from biobased sectors, allowing visitors to discover and explore new options. This exposure to biobased products and concepts enhances awareness and understanding. Information Sharing: Students highlight that fairs and markets offer a chance for them to gather information and share it with their families. They see these events as platforms to acquire knowledge about biobased sectors and bring back this information to their households, potentially influencing their families' perspectives and choices. Personal Disinterest: One student expressed personal disinterest in fairs and markets as a user. This individual does not find the activity appealing or engaging, suggesting that preferences can vary among students.
Living Labs & co-creation activities	**10/13**	**3/13**	Intriguing and Engaging: Students find Living Labs and co-creation activities to be intriguing. These activities offer a unique opportunity to synthesise information, bringing together various perspectives, knowledge, and expertise. Students appreciate the challenge and intellectual stimulation that comes from working on complex problems collectively. Innovative Ideas: Students acknowledge that Living Labs and co-creation activities have the potential to generate innovative ideas. They recognise that when different people with diverse backgrounds, skills, and experiences collaborate, it sparks creativity and fosters the emergence of novel solutions and approaches.
Challenges	**10/13**	**3/13**	Interesting and Competitive: Students find challenges to be highly interesting due to the element of competitiveness they offer. They enjoy engaging in activities that involve competition, as it adds excitement and motivation to their participation. Reward Incentive: Students mention that challenges become more appealing when there is a reward involved. The prospect of receiving a reward serves as an incentive for their active participation and involvement in the challenge. Lack of Interest in Certain Challenges: Students mention that not all challenges are equally interesting. They highlight the importance of designing challenges

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			that capture their attention and engage them in a meaningful way. Challenges that focus on simple tasks, such as recycling a specific number of packaging, may not be perceived as interesting or stimulating enough. Potential Lack of Learning: One student expresses the concern that challenges, despite their excitement and reward incentives, may not necessarily lead to actual learning. They believe that the primary goal of challenges should be focused on learning rather than solely on competition or rewards.
Citizen science activities	**9/13**	**4/13**	Interest and Fun: Students generally find citizen science activities to be very interesting and enjoyable. They appreciate the engaging and interactive nature of these activities, which often involve active participation and hands-on experiences. Previous Positive Experience: One student, who has participated in citizen science activities before, expresses confidence that they would enjoy such an activity within an educational setting. This suggests that students who have prior experience with citizen science value its benefits and are likely to find it engaging and fulfilling. Involvement of Scientists: Students highlight the significance of scientists' involvement in citizen science activities. The presence of scientists adds credibility and purpose to the activities, allowing students to work alongside professionals and gain valuable insights into scientific processes. Extraordinary Learning: Students appreciate that citizen science activities offer a departure from everyday regular activities. They perceive these activities as extraordinary and creative ways to learn, providing them with unique and memorable experiences. Intriguing and Willingness to Try: Students express intrigue and curiosity about citizen science activities. They show eagerness to try out these activities, even if they haven't participated in them before. This indicates a willingness to engage with citizen science and explore its potential educational benefits.
Video games / Apps	**8/13**	**5/13**	Learning vs. Game: Students believe that when something has the primary purpose of learning, it no

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			longer feels like a game. They prefer games that are purely meant for entertainment rather than those designed explicitly as educational tools. Lack of Interest: Students expressed that games intended for educational purposes are generally not very interesting to them. The focus on learning may diminish the enjoyment factor and fail to capture their attention and engagement. Seriousness and Engagement: According to student feedback, games designed with the explicit purpose of education might not be taken seriously by children. They may not engage with these games as they would with purely recreational ones, potentially reducing their effectiveness as learning tools. Incorporating Elements into Existing Games: A student suggested taking an existing video game, such as Call of Duty, and integrating bioeconomy elements into it. The idea behind this suggestion is to create an engaging result that combines educational content with the fun and excitement of an existing popular game. The student believes that by starting with a game that is already enjoyable, the learning elements can be seamlessly integrated, making the overall experience both educational and fun.
Debates & focus groups	**8/13**	**5/13**	Enriching and Stimulating: Students find debates and focus groups to be enriching activities. They appreciate the opportunity to listen to different arguments and perspectives, which broadens their understanding of various topics. Engaging in debates is seen as a stimulating activity that encourages critical thinking and analytical skills. Interaction and Expression: Students value the interactive nature of debates and focus groups. These activities provide a platform for students to actively participate, engage in discussions with their classmates, and express their own opinions on the topic being debated. They appreciate the opportunity to voice their thoughts and engage in meaningful conversations. Exploring Different Perspectives: Students find debates valuable because they allow them to explore an issue from different sides of an argument. This promotes a

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			deeper understanding of complex topics, fosters empathy, and encourages students to consider different viewpoints. Potential Disputes and Linguistic Competence: A student expressed concerns about debates potentially leading to disputes among participants. They mention that at their age, linguistic competence may be limited, and this could hinder effective communication and understanding during debates. This drawback highlights the need for supportive facilitation and clear guidelines to ensure a constructive and respectful exchange of ideas.
Experiments	**7/13**	**6/13**	Engaging and Hands-on Learning: Students find experiments to be highly engaging and enjoyable. The interactive nature of experiments allows them to actively participate and explore concepts in a practical manner. This hands-on approach to learning is seen as more effective in understanding and retaining information compared to passive learning methods like memorisation. Enhanced Understanding: Students appreciate how experiments make abstract concepts more tangible and easier to comprehend. The practical aspect of conducting experiments helps them visualise and experience the principles being taught, leading to a deeper understanding of the subject matter. Lack of Interest Compared to Other Activities: While most students find experiments engaging, one student expresses a personal preference for other activities over experiments. It's important to note that individual preferences can vary, and not all students may find experiments to be their preferred mode of learning.
Recipe book	**7/13**	**6/13**	Waste Reduction: Students find recipe books to be effective tools for reducing waste. They appreciate that recipe books provide practical solutions for utilising leftover ingredients or resources that would otherwise be discarded. By offering creative ideas and alternative uses for leftovers, recipe books help students minimise waste and promote sustainability. Enjoyment of Cooking: Students who enjoy cooking find recipe books to be particularly appealing. They appreciate the opportunity to explore new recipes, techniques, and flavours while also making a positive

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			impact on the environment. The combination of cooking and waste reduction aligns with their interests and provides a sense of fulfilment. Celebrity Chefs and TV Shows: One student suggests that famous chefs on TV should showcase recipes that specifically utilise leftovers. They believe that popular chefs have the influence to inspire a broader audience to adopt waste-reducing practices through their cooking shows. This suggestion aims to raise awareness and encourage more people to embrace sustainable cooking habits.
Hackathon	**6/13**	**7/13**	Stimulation and Collaboration: Students find hackathons to be stimulating activities. Working in small groups with their classmates allows them to brainstorm and create new ideas collectively. The collaborative nature of hackathons fosters teamwork and encourages students to leverage their individual strengths to accomplish a common goal. Personal Interest and Autonomy: Students appreciate the opportunity to work on projects that align with their own interests and preferences. Unlike activities that are imposed on them, hackathons allow students to pursue ideas and concepts that they find personally appealing. This autonomy enhances their motivation and engagement in the activity. Comparatively Less Interesting: One student mentions that, in comparison to other activities, they do not find hackathons as interesting. This suggests that personal preferences and individual interests play a role in determining the level of engagement and enjoyment students derive from hackathons. Potential Diminishing Appeal: Another student expresses the concern that hackathons may lose their appeal if repeated frequently. The initial excitement and novelty of the activity might wear off with repeated participation, reducing its overall attractiveness.
Artistic activities	**6/13**	**7/13**	Holistic Approach: Students find that artistic activities offer a comprehensive and well-rounded approach to learning. By incorporating arts into the curriculum, students can explore a subject from different angles and perspectives, fostering a deeper understanding and appreciation.

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			Effective Communication: Artistic activities are seen as a useful tool for disseminating messages and stimulating people's thoughts and emotions. Through various artistic mediums, students can express their ideas, raise awareness, and engage with others in a meaningful way. Freedom and Creativity: Arts provide students with a sense of freedom and self-expression. Unlike some other subjects, artistic activities often allow for more personal interpretation and creativity. Students appreciate the opportunity to explore their own ideas and make things on their own, such as engaging in pottery or other hands-on artistic endeavours. Limited Reach: Students acknowledge that artistic activities may resonate with a limited number of students. While some students may be drawn to and benefit greatly from artistic pursuits, others may not find them as engaging or relevant to their interests. Using artistic activities alone, without combining them with other approaches, may not be as effective in reaching a broader student population.
Field trips	**6/13**	**7/13**	Learning Opportunities: Students recognise that field trips provide an opportunity to learn new and interesting things. They appreciate the practical, hands-on experiences that field trips offer, allowing them to gain knowledge outside the traditional classroom setting. Outdoor and Nature Exploration: Students express a preference for field trips that take place outdoors, in natural environments. They find these types of trips more engaging and enjoyable compared to educational visits to indoor locations. Non-Traditional Visits: Students specifically mention their preference for field trips that involve non-traditional visits, such as interactive museums. They value interactive and engaging experiences that go beyond passive observation, as these types of visits tend to be more exciting and memorable. Boredom in Educational Visits: Some students mention finding educational visits, particularly in museums,

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			boring. They may perceive these visits as less engaging or less aligned with their personal interests.
Storytelling	**6/13**	**7/13**	Effective Message Transfer: Students recognise storytelling as an effective means of conveying a message to a wider audience. They appreciate the ability of storytelling to simplify complex concepts and make them easily understandable for everyone. Engagement through Humour: Students find storytelling with the element of humour to be particularly interesting. The incorporation of humour adds an entertaining aspect to the activity, making it more engaging and enjoyable. Adding Bioeconomy Element: Students suggest that incorporating the element of bioeconomy into storytelling can make the activity even more interesting. By first creating an engaging story and then adding the bioeconomy aspect, they believe it can help maintain the audience's interest and prevent the activity from becoming boring. Boredom and Fatigue: One student expresses boredom and tiredness towards storytelling as an activity. They may find it less captivating or may prefer other types of activities over storytelling.
BioMarathon competitions & contests	**5/13**	**8/13**	Motivation and Incentives: Students find the inclusion of prizes in BioMarathons, competitions, and contests to be useful. The element of prizes serves as a motivation for students to actively participate, go the extra mile, and strive for success. The potential rewards act as an incentive that pushes students to put in their best effort. Goal-Oriented Approach: Some students suggest that competitions could be more effective if they were based on achieving a specific target or goal, such as recycling a certain amount of plastic. This approach shifts the focus from individual competition to collective achievement, where multiple winners can be recognised. This promotes teamwork and cooperation among students rather than fostering a cutthroat competitive environment. Risk of Cheating: Students mention that the competitive nature of BioMarathons, competitions, and contests can sometimes lead to cheating. The

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			intense desire to win may prompt some students to resort to unethical practices, compromising the integrity of the activity. The incident of cheating during a past recycling marathon serves as evidence of this issue.
Social media	**4/13**	**9/13**	Communication and Awareness: Students recognise the effectiveness of social media as a means of communication and raising awareness about topics such as bioeconomy. They acknowledge that social media platforms provide an opportunity to reach a wide audience and spread information efficiently. Influence of Peers: Students highlight the influence of their peers on social media. They believe that if their friends or peers discuss or promote bioeconomy on social media, it would be an effective way to capture their attention and encourage them to explore and engage with the topic. Seeing someone they know and trust discussing bioeconomy could inspire them to follow suit. Incorporation by Influencers: One student suggests that incorporating relevant information about bioeconomy into the content of established social media influencers could be an effective strategy. Leveraging the existing following and influence of these individuals can help in spreading the word about bioeconomy to a larger audience. Preference for Leisure and Fun: The majority of students express a preference for using social media as a means to unwind, have fun, and connect with friends during their free time. They indicate that they do not generally seek to utilise social media for educational purposes or specifically explore topics like bioeconomy through these platforms.
Intergenerational activities	**4/13**	**9/13**	Lack of Interest: Students, for the most part, express a lack of interest in intergenerational activities when compared to other activities. They may feel that these activities are less appealing, possibly due to a phase of adolescence where they tend to avoid activities associated with their parents or grandparents. Not as Interesting as Other Activities: Some students explicitly mention that intergenerational activities are not as interesting as other activities they may prefer.

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			This suggests that they may find alternative activities more engaging or enjoyable. Wider Experiences: Students recognise the value of intergenerational activities in terms of the older generation's broader life experiences. They acknowledge that interacting with older people can provide valuable insights and perspectives that younger individuals may not have. Beautiful Experience and Family Connection: One student shares a positive personal experience, describing intergenerational activities as a beautiful experience and an opportunity to spend more time with family and ancestors. They appreciate the chance to strengthen bonds and connections with their relatives. Established Communication: Students note that engaging in intergenerational activities with family members whom they already have established communication with, can make the experience easier and more comfortable. This is in contrast to activities involving experts or unfamiliar individuals.
Podcasts	**3/13**	**10/13**	Lack of Interest: The majority of students express a lack of interest in podcast activities, as they themselves do not frequently use or listen to podcasts. This suggests that podcasts may not align with their preferred mediums of entertainment or learning. Boredom: A student specifically mentions that podcast activities are boring. They may perceive podcasts as less engaging or captivating compared to other activities available to them. Students may prefer alternative methods that they find more interesting and exciting for exploring and enhancing their understanding of bioeconomy.

Table 47: Proposals for 14-1- year-old students

This section provides the synthesises of the results and the feedback provided by the focus group teacher participants following the discussion teachers had with their students on the proposals for bioeconomy education co-created in the GenB Common Ground Camp. In the sections below a detailed overview of results and comments provided by teachers following the discussion with their students per target group for each proposed activity, with additional comments and insights obtained during the sessions.

Pan- European: Synthesis of results of the focus group with teacher participants teaching 14-19-years-old students

For this age group, a total of 17 proposals are considered. An overview of likes and dislikes of the activities, as well as the rationale behind specific choice can be seen in the table below (see Table 48).

PROPOSALS 14-19 y.o.			
PROPOSAL	**Nº LIKES**	**Nº DISLIKES**	**COMMENTS**
Field trips	163	-	Field trips present an opportunity to engage with the community, allows them to get engaged in experiential learning, to explore the outdoors and acquire information about life.
Challenges	151	-	Students think challenges spark enthusiasm and creativity, critical thinking, and collaboration. Moreover, challenges allow working with real life problems and practicing skills developed in school.
Podcasts	147	-	Students considered this format a very effective way of communicating ideas and information, and it can be used in various subjects. However, some students expressed that Bioeconomy as a topic would be hard to be presented in a podcast format.
Games	144	-	Students indicated that games are an informative source and an interactive and appealing tool in education. When it comes to Kahoot games, students from Italy, Sweden, and North Macedonia (students of Participant teacher 20, 21 and 24) enjoy the game, whilst their peers from Croatia (students of Participant teacher 25) find it overstimulating and more appropriate for younger students.
Video games / Apps	132	17	Games expect and encourage players to finish missions as they complete levels, allowing them to dive in, learn about and explore deeper concepts and different topics. Students who disliked the activity indicated that they do not consider games as an effective way of learning, but rather just for entertainment.
Debates & focus groups	124	12	Students indicated that they enjoy discussions, this format helps them listen, prepare and learn about new topics. It allows them to learn from classmates, consider new perspectives and points of view. Students who disliked the activity indicated that they consider it a long format.
Experiments	123	-	They enjoy experiments because they can manipulate the outcomes, collaborate with each other, discuss with the teacher, see different outcomes based on the

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PROPOSALS 14-19 y.o.			
PROPOSAL	Nº LIKES	Nº DISLIKES	COMMENTS
			manipulations, discover what happened, reflect on the learning process.
Social media	114	20	Students noted that they enjoy using social media and find it an effective way of sharing information. Students who dislike this activity indicated that social networks are not a reliable source of information, provide subjective opinions, people answer emotionally not rationally.
Storytelling	113	20	Students indicated that this format is similar to podcasts, that it is an effective way of sharing information and learning about new ideas and concepts. Students who disliked the activity, indicated that it is more suitable for younger students.
Living Labs & co-creation activities	106	-	Students noted that Living Labs presented a valuable way of interaction and obtaining information. This format encourages teamwork, sharing thoughts, brainstorming and discussion.
Artistic activities	88	-	Mainly female students choose this activity format. Students indicated that art helps them to express thoughts and be creative. Students who did not choose it noted that this activity can be difficult and not everyone is artistically inclined.
Fairs / markets	86	12	Fairs represent unique opportunities for students to present their efforts from class, it requires research and allows students learn from each other, see different aspects of each subject. Students also indicated that it fosters entrepreneurial spirit and allows practicing different communications skills.
Citizen science activities	75	-	Teachers indicated that students initially did not know what citizen science activities entailed and required additional information.
Bio marathon, competitions & contests	61	10	Students enjoy challenging and competing; it also allows them to take part in local events. Students who disliked the activity indicated that competitions make them feel insecure.
Intergenerational activities	56	-	Majority of students indicated that this format is new for them. They like it as it encourages group work and collaboration.

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PROPOSALS 14-19 y.o.			
PROPOSAL	**Nº LIKES**	**Nº DISLIKES**	**COMMENTS**
Recipe book	52	7	Students indicated that they are not very interested in recipe books, they do not like writing and consider this activity more suitable for younger students. They consider that it would just be a reading activity and does not serve the purpose of the topic.
Hackathon	43	-	Majority of students indicated that this format is fairly new for them. However, they like it as it encourages group work, collaboration and fast paced problem solving.

Table 48: Proposals for 14-19-year- old students

Participating teachers indicated that it is important to consider the type of school when choosing activities, as a part of the sample, 4 teachers were teaching in specialised or vocational schools, and in this case the frequency of the classes in certain subjects (for example arts in art schools) affected the choice of activities. An overlapping point in all target groups was the choice of activities in which they do not often have an opportunity to engage.

6.3 Conclusions: overview

After the presentation of the most relevant results for each activity, this section summarises the main findings for each age group.

First of all, the findings related to the interests and profiles of students in each age group are presented. This information is essential to guide the design and implementation of didactic activities and proposals aimed at learning about the Bioeconomy, which are connected and adapted to the interests of the age group. In this way, students' motivation and engagement will be fostered and the development of meaningful learning will be facilitated.

This is followed by information on the validation of the didactic proposals for Bioeconomy education co-created during the GenB project's Common Ground Camp in Athens. At this point, the proposals that have received the greatest interest from the students are highlighted, with the aim of guiding the future development of the project.

First of all, general conclusions are given on the development of the focus groups. After that, following the same scheme as in the previous sections, the conclusions are presented classified by age group. For each age group, the overall findings are detailed, and finally the country-specific findings are given.

6.3.1 General conclusions

The main conclusion is that the didactic proposals to educate in Bioeconomy co-created in the Common Ground Camp of the GenB Project have raised the interest of the students participating in the focus groups and, in most cases, have been attractive for them.

Furthermore, despite the fact that the students had practically no knowledge of Bioeconomy (and many of them were even completely unaware of the concept before participating in the focus groups), they found it an interesting topic and consider that working on it and learning about it is an important issue in order to move towards more sustainable models.

These conclusions are very positive and highlight the importance and the need to continue working on the topic and to implement the GenB project in order to educate the younger generations in the bioeconomy, given the leading position that children and young people hold in current and future society, and the role that they can play in the transition towards a sustainable and circular Bioeconomy.

Finally, as regards preferences in terms of activities to learn about Bioeconomy, students across all 3 target group ages choose activities that would require collaboration and group engagement, as well as activities that would allow them to be an active part of the learning process. As they spend a lot of time online and on their computers, even in school, they choose activities that would allow them exchange, collaboration, and hands-on experience. Teachers emphasised that after the pandemic, students are more inclined to take part in real-life experiences, outside of schools, to be engaged with the community and each other.

Students also enjoy gamified experience, in a virtual and real-life setting. They believe that they can benefit from gamification in different formats, with the preference of including gamification in face-to-face activities. They enjoy competing but collaborating in the process, fostering healthy competition among themselves and within oneself.

They also enjoy formats that facilitate communication and the exchange of ideas and knowledge, such as podcasts, and appreciate truthful and accurate information on which to form their opinion.

Lastly, students are also interested in experimental activities, based on hands-on approach, which allow them to interact directly with different resources, materials and formats.

6.3.2 Conclusions for the 4-8-years-old age group

Firstly, as regards the interests of children aged 4 to 8 years old, the child profiles most present at this stage are: Creative Heroes, Green Explorers and Notable Achievers.

Based on these results, it can be deduced that the activities and didactic proposals for education in Bioeconomy aimed at this age group should be presented as challenges that contribute to improving society and the life of people and living beings in general, also highlighting the positive impact that these actions can have on the environment. In this way, proposals adapted to the interests of children of this age group will be offered.

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In terms of favourite activities, games are the most attractive activity among the participating children, ranking in the Top 3 in both the AIJU and EUN focus groups. It can be concluded that gamified activities based on a playful-pedagogical approach can be an excellent didactic resource to promote learning about the Bioeconomy in this age group. Children of this target group love to learn while having fun and sharing experiences with others, so cooperative and team games can facilitate this process.

In addition, cooking workshops are also highlighted by the children participating in the focus groups developed by HSPN and EUN, as they offer students the possibility of interacting with real resources and developing experiences based on hands-on learning.

Another example of an activity that captures the interest of children from 4 to 8 years old is the celebration of fairs, since learning takes place in relation to other people, especially highlighting the importance and interest in experiencing shared moments with their family, friends and teachers.

Field trips also appeal to this age group. They like to be outdoors and do activities in nature. So, they think that this activity is a very fun and attractive way to learn new things. They also relate it to the concept of research.

Finally, other activities that also appear in the Top 3 in some of the countries are learning through videos and songs (AIJU) and conducting focus groups (HSPN).

6.3.2.1 Spain: Conclusions for the 4-8 y.o. age group

A total of 11 proposals were presented for this age group, that were categorised into 3 different dimensions: introduction activities, development activities and concluding activities. This structuring responds to the approach co-created in the Common Ground Camp.

In general terms, the 11 proposals presented managed to generate interest and engagement among the participating children. This demonstrates their effectiveness and adaptation to the characteristics and interests of the target group.

At the end of the session, each participant was requested to choose their favourite activity. The results of this choice are shown in Table 49.

GENERAL RANKING 4-8 y.o. -SPAIN	
PROPOSAL	**COMMENTS**
1.Videos	Participants are most positive about this proposal. It is an activity that everyone is familiar with, and which they find fun and attractive. In fact, most of them say that they could spend the whole day watching videos, although they are limited in terms of content and time by their parents. They say that they would really like to learn about Bioeconomy through videos.
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2.Puppets/ Fair-market/ Games	They like puppets and find them fun. They think they are a good resource for telling and creating stories about elements and concepts of Bioeconomy, and for learning through dramatization too. They enjoy both watching plays with puppets and creating the plots themselves. They would also like to make their own puppets from bio-based products or waste.
	FAIR - MARKET Fairs and markets are attractive activities for them. They emphasise that they would like to visit them with their family and friends and see the things on display. In addition, they would also like activities such as workshops, theatre performances, etc. to be organised at the fair, and they would like to participate in them.
	GAMES All participants enjoy playing games. Especially group and shared games, where they can share activities and dynamics with their friends. They would like to learn about Bioeconomy through games, because they find it fun.
3.Songs	Songs are also considered a good educational resource. Everyone loves songs, especially when they are combined with dances. Most are happy to sing, with the exception of some children who report shyness.

Table 49: General ranking 4-8 y.o.

6.3.2.2 Greece: Conclusions for the 4-8 y.o. age group

Based on the insights gathered during the "My favourite things is..." activity, Table 50 presents the ranking of proposals that received the highest value from the participants. It showcases their preferences and highlights the activities they find most appealing and valuable.

GENERAL RANKING 4-8 y.o. - GREECE	
PROPOSAL	**COMMENTS**
1.Fair	Fairs were seen as fun and exciting, allowing the students to showcase their creations and interact with others. Furthermore, students enjoyed the hands-on aspect of creating things and having the chance to sell them, which enhanced their engagement and sense of ownership.
2.Cooking workshops	The students found the activity exciting and enjoyable, as it allowed them to explore their culinary skills, learn about different ingredients, and create something delicious. The interactive nature of cooking workshops sparked their curiosity and fostered a sense of accomplishment as they prepared and tasted their culinary creations.

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3.Group discussions	The students expressed their enjoyment and appreciation for participating in group discussions as they provide a platform for students to express their thoughts, share ideas, and learn from one another. While some students mentioned a preference for working independently in certain situations, they recognised the value of group discussions in fostering teamwork, cooperation, and social interaction.

Table 50: General ranking 4-8 y.o.

In conclusion, the focus group with the students provided valuable insights into their preferences and perspectives on various activities related to bioeconomy. The findings revealed a range of opinions and preferences among the participants. While some activities were highly favoured, such as cooking workshops and games, others received mixed responses or were less popular, such as touching or smelling bioeconomy materials and puppetry. It is important to consider the individual preferences and interests of students when designing educational activities and promoting engagement in the subject of bioeconomy. By incorporating the activities that resonate with students and align with their learning styles, we can create a more effective and enjoyable learning environment. Furthermore, the focus group discussions highlighted the importance of considering factors such as personal interests, group dynamics, and individual comfort levels when planning and implementing educational initiatives. Overall, these insights will contribute to the development of engaging and effective strategies to promote bioeconomy education among students.

6.3.2.3 Pan-European: Conclusions for the 4-8 y.o. age group

Based on the results indicated in Table 38, Table 39 and Table 40, and the feedback obtained from the teacher participants, an overall ranking of activities has been conducted. An overview of the highest ranked activities can be seen in the table below, as well as a conclusion on the proposed formats (see Table 51).

GENERAL RANKING 4-8 y.o. – PAN-EUROPEAN	
PROPOSAL	**COMMENTS**
1.Visit to the countryside	Students enjoy field trips and experiential learning, connected to the real world, that takes place outside of classrooms. It allows them to be more active, curious, and engaged in the learning situation.
2.Games	Games allow students to collaborate, challenge and compete. They indicated that they would prefer more outdoor and group games rather than online activities.
3.Cooking workshop	One of the teachers indicated that their students were very interested in this activity as in their school students are not allowed around the kitchen, and they would be interested in the process. Other teacher indicated that students would be interested in even creating small dishes that do not require proper kitchen.

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Table 51: General ranking 4-8 y.o.

Based on comments from students and teachers, students usually choose activities that they lack in their everyday learning process, new formats, and activities they would like to try. Moreover, they preferred more hands-on activities that would allow them to work together in a group and be an active part of the learning process. They preferred activities based on real-life issues and interactions that would take them outside of the classroom. Students also mentioned that they would like to see more formats related to arts and artistic activities.

6.3.3 Conclusions for the 9-13 age group

Firstly, as regards the interests of children aged 9 to 13 years old, the child profiles most present at this stage are: Notable Achievers, Experimental Makers and Green Explorers.

Based on these results, activities designed to educate students in this age group in Bioeconomy should provide them with challenges and problems that require them to put their skills, both mental and physical, into practice. Similarly, the competitive component combined with elements of cooperation can be highly motivating for this age group. In this sense, activities such as competitions, BioMarathons, etc., in which pupils can work in teams to achieve a goal can capture their interest.

In addition, activities should offer possibilities to work with different materials, resources and formats, especially based on manipulative, experiential and hands-on learning, such as workshops, experiments, etc.

Finally, it is also interesting to connect Bioeconomy education activities with sustainability and care for the environment, the planet and all the species that inhabit it.

In terms of activities, the only activity that does not capture the interest of this age group is pop-up books, being the only activity considered whose number of dislikes exceeds the number of likes. The arguments justifying this rating are that this resource is considered to be appropriate to younger age groups. In other words, children consider it to be a childish resource, intended for younger children, and therefore it does not provide aspirational value.

The most popular activity for children of this age group in the different countries is games. There is a strong consensus on the attractiveness of games as a didactic strategy to favour learning about Bioeconomy, and to develop learning experiences in general. Games appear in the top 3 of the focus groups developed by all partners (AIJU, HSPN & EUN). Children consider that it is a fun and motivating learning approach. They also add that they find it a more entertaining and up-to-date learning option than textbooks.

Experiments also appear in the Top 3 of two of the partners (AIJU & EUN). Activities based on the experimental approach generally appeal to this age group and are rated positively.

Another interesting activity for this age group is role-playing, which ranks in the top 3 of the focus groups developed by EUN & HSPN. The possibilities to reproduce scenes and situations and to put themselves in other people's shoes are stimulating for children.

Finally, other activities that also appear in the Top 3 in some of the countries are: fairs (HSPN), research projects, focus groups and workshops (AIJU).

6.3.3.1 Spain: Conclusions for the 9-13 y.o. age group

A total of 11 proposals were presented for this age group.

At the end of the session, each participant was requested to choose their favourite activity. The results of this choice are shown in Table 52.

GENERAL RANKING 9-13 y.o. - SPAIN	
PROPOSAL	**COMMENTS**
1.Games	They value positively the idea of learning in a gamified way, it is fun and motivates them. They especially value games that can be shared with other classmates, and in which teams are created. At the same time, they also like games that have a competitive component.
2.Research Project / Debates & Focus Groups	**Research project** Participants find the concept of mystery and research very interesting and fun. It allows them to discover new things, to research using technologies. It should be noted, however, that one participant identifies the possibility of not finding what you want and the fear of not knowing how to search well as a brake.
	Debates and focus group They find it an interesting approach because it is a way for everyone to share their opinions. They find it particularly attractive to be asked for their opinion. They value the idea of talking to people and reaching agreement. However, there is a perception that debates can create conflicts, awkward and tense situations because of the discussion itself and because at the end of the discussion, there is a winner and a loser.
3.Workshops / Experiments	**Workshop** It is attractive to work in a group and to be able to integrate everyone's ideas. However, there is a brake on the conflicts that can arise between colleagues when they do not agree.

	Experiments: soap making They find it an interesting and fun activity for their age group. It allows them to achieve other types of learning, more manipulative and experiential, which they find more attractive.

Table 52: General ranking 9-13 y.o.

6.3.3.2 Greece: Conclusions for the 9-13 y.o. age group

Based on the insights gathered during the "Top 3 best proposals" activity, Table 53 presents the ranking of proposals that received the highest value from the participants. It showcases their preferences and highlights the activities they find most appealing and valuable.

GENERAL RANKING 9-13 y.o. - GREECE	
PROPOSAL	**COMMENTS**
1.Games	The findings indicate that games are highly regarded by the participants as enjoyable and engaging activities. Students expressed their appreciation for the fun and interactive nature of games, emphasising that they contribute to a more enjoyable learning process. The positive perception of games suggests that they have the potential to enhance student engagement and motivation in educational settings.
2.Role playing	The results highlight the positive perception of role-playing games among the participants, who found them to be enjoyable and engaging activities. The majority of students expressed their appreciation for the interactive and entertaining nature of role-playing games. This suggests that these games hold significant appeal and capture the interest of the student group.
3.Fairs and markets	The findings reveal that fairs and markets provide a unique platform for creativity and the expression of individuality. Students expressed their enthusiasm for participating in fairs and markets, emphasising the opportunity to showcase their talents and creative endeavours. Furthermore, students highlighted the opportunity to contribute to a good cause through these events, particularly through donating. The combination of creativity, personal expression, and the opportunity to contribute to a good cause through donations further enhances the appeal and value of fairs and markets in the eyes of the students.

Table 53: General ranking 9-13 y.o.

In conclusion, through the focus groups with 9-13-year-old students, we have gained valuable insights into their preferences and perspectives regarding various activities related to bioeconomy. The discussions have highlighted their interests, concerns, and preferences, allowing us to better understand how to engage and educate this age group effectively. It is clear that these students appreciate hands-on and interactive activities such as experiments, games,

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and creative projects. They also value activities that promote collaboration, critical thinking, and problem-solving skills. However, it is important to note that individual preferences may vary, and considerations should be given to accommodate diverse interests and learning styles. Overall, the findings from the focus groups have provided a foundation for designing targeted educational initiatives and strategies that will engage and inspire these young learners to explore and embrace the principles of bioeconomy in an enjoyable and meaningful way.

6.3.3.3 Pan-European: Conclusions for the 9-13 y.o. age group

Based on the results indicated in Table 44, and the feedback obtained from the teacher participants, an overall ranking of activities has been conducted. An overview of the highest ranked activities can be seen in the table below, as well as a conclusion on the proposed formats (see Table 54).

GENERAL RANKING 9-13 y.o. – PAN-EUROPEAN	
PROPOSAL	**COMMENTS**
1.Games	Students consider games as an effective way of learning. They love creating, developing, and playing games. Games allow them to collaborate, learn in a more imaginative way, explore ideas, and express themselves, as well as challenge and compete. They also emphasised that they like outdoor games and would like to have these options of activities.
2.Role-playing	Students often choose this activity as it allows them to assume different roles and imagine and experience world from different perspectives. Teachers indicated that this activity allows them to reflect on themselves, their opinions and learn from each other.
3.Experiments: soap making	Students indicated that they like this activity as it is a hands-on type of activity, that allows them to be active, to manipulate outcomes, learn by doing, collaborate with each other

Table 54: General ranking 9-13 y.o.

Primary school students selected formats that foster their creativity and collaboration, while keeping them active and in control of their learning environments. These choices allow them to manipulate their learning environments, to assume different roles and create a more pleasant, hands-on and inclusive learning process. Assuming different roles in an online world in video games, or in real one with role playing or other games allows them to practice a vast variety of skills such as empathy, active listening, collaboration and argumentations. It allows them to express themselves and be more in control of the learning experience outcome.

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6.3.4 Conclusions for the 14-19-years-old age group

Firstly, as regards the interests of youngsters aged 14 to 19 years old, a great diversity of interests and motivations can be seen. This fact is evidence of the personality traits of these participants, who are already close to the beginning of adulthood.

In general terms, this group shows a preference for activities that allow them to interact with other people and share experiences and moments. They especially value sharing time with young people of their own age, both their friendships and meeting new people with whom they can socialise. Therefore, activities that offer possibilities for interaction, discussion and co-creation can be excellent didactic proposals for this group.

In addition, young people in this age group also show a strong interest in topics and events that are trending or fashionable in today's society. In this respect, fashion is a topic of great interest to young people and offers many possibilities for working on the bioeconomy. Entrepreneurship and digital technologies also attract their attention, so harnessing the potential of social networks, video games and digital technologies in general can help to facilitate the engagement of these students.

Finally, this age group also values positively those activities that allow them to express their own personality and identity, given the key role that these aspects play at this stage. One of the most important resources that can best contribute to this is art and the various artistic manifestations, whether through music, dance, performance and theatre, cooking or the plastic arts.

As a result of the great variety of interests in this age group, there is also a wide dispersion in terms of preferences for co-created didactic proposals. Specifically, of the 17 proposals considered, 12 are placed in the Top 3 of one of the countries.

The only proposals that do not appear in the Top3 are: citizen science activities, debates and focus groups, Hackathons, intergenerational activities and storytelling. As far as open science activities are concerned, they seem to them to be more formal and academic activities, causing them to reject the idea. In relation to focus groups, they prefer Living Labs, and the same goes for Hackathons, which are less popular than BioMarathons. With regard to intergenerational activities, they are more interested in sharing time and space with people of the same age. Finally, with regard to storytelling, it seems to them to be a childish activity, more appropriate for children than for young people of their age.

Finally, as far as favourite activities are concerned, field trips appear in the Top 3 of the focus groups developed by AIJU & EUN partners. About this activity, they especially value the possibilities of interacting with other people and sharing moments with their friends and peers. In addition, they highlight the playful dimension of these activities.

Recipe books also capture the interest of AIJU & HSPN students. Cooking seems to them to be a very interesting and useful activity, and they consider it to be a good didactic strategy.

Other activities that appear in the Top3 of some of the partners are challenges and podcasts (EUN), fairs, BioMarathons and videogames (HSPN) and experiments, social networks, games, artistic activities and Living Labs (AIJU).

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In conclusion, this variety of interests and preferences highlights the importance of offering multiple activities with different formats and approaches for this age group, as well as personalised learning experiences.

6.3.4.1 Spain: Conclusions for the 14-19 y.o. age group

For this age group, 17 proposals were presented.

At the end of the session, each participant was requested to choose their favourite activity. The results of this choice are shown in Table 55.

GENERAL RANKING 14-19 y.o.	
PROPOSAL	**COMMENTS**
1.Recipe book	They consider it a very practical and useful proposal. They think that it connects with the interests of today's young people and that it can communicate a lot of content about Bioeconomy. Not only about bio cuisine, but also about the consumption of local products, plant care (compost, irrigation, etc.). They stress that in order for the recipes to become popular and achieve greater reach and dissemination, it would be useful to share them on TikTok, in a fun way and highlighting the ease of preparing the recipe. They would also like some influencer related to cooking (programmes such as Master Chef and its participants) to make a book or talk about the subject. They believe that if the recipes can be made with homemade ingredients, many people would be encouraged to make them.
2.Experiments	They value this proposal as very interesting because of the curiosity it arouses, and because it has a certain component of "surprise factor" and the uncertainty of not knowing what is going to happen. It is interesting both at school level and on social networks such as TikTok, where a short video can capture the attention of many people and an experiment is easy and fun to consume. They have very good memories of experiments they did when they were children and it is said to be especially interesting at primary and secondary school level.
	Social Media In this age range, it can be seen that social media are part of the daily life of young people and they do not highlight this as a proposal in itself, but rather that for them most of the proposals have to be on social networks in order to be successful. An example of this is that in the proposals that have been most liked (Recipes and Experiments) they demand their dissemination on social media.
	Games

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3.Social media/ Games/ Artistic activities / Field trips / Living Labs	It is an entertaining proposal that allows them to learn contents and concepts in a dynamic and different way. They believe that it can be of interest to young people because it is fun and motivates them.
	Artistic activities The relationship between fashion and the artistic world has been a key factor in arousing interest in this proposal. They believe that it could be of particular interest to the upper end of the target group, young people between 17 and 19 years of age.
	Field trips This approach is particularly popular in education, as it is a much more enjoyable and fun way of compulsory learning.
	Living Labs They value the opportunity to socialise, interact and create knowledge in a shared way.

Table 55: General ranking 14-19 y.o..

Table 56 presents a ranking of the proposals that received the highest level of appreciation from the participants. It showcases the most favoured options and provides insights into the reasons behind their positive reception. The table aims to capture the proposals that garnered favourable comments, highlighting the factors that contribute to their popularity among the participants.

GENERAL RANKING 14-19 y.o.	
PROPOSAL	**COMMENTS**
1.Fairs / markets	The findings reveal that fairs and markets were perceived as enjoyable and creative activities by the participants. The majority of students expressed positive sentiments towards these events, highlighting their fun and imaginative nature.
2.Recipe book	The findings indicate that recipe books were regarded as useful by the participants. Students expressed that recipe books served a practical purpose, helping them effectively reduce waste and utilise leftover resources. The majority of students recognised the value of recipe books in providing guidance and inspiration for sustainable cooking practices.
3.BioMarathons / Video games	**BioMarathons** The findings reveal that BioMarathons, competitions, and contests are perceived as engaging activities by the participants. Students expressed their enthusiasm for these competitive events, highlighting the element of challenge and the opportunity to showcase their skills and knowledge. The competitive nature of BioMarathons, competitions, and

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	contests was seen as a motivating factor, encouraging active participation and a sense of achievement. These findings suggest that such activities have the potential to captivate and inspire students in the context of bioeconomy education.
	Video games The findings indicate that video games hold a prominent place in the everyday lives of students, being an integral part of their daily routines and leisure activities. The immersive nature of video games, combined with their interactive and engaging elements, was highlighted as a key factor contributing to their appeal. These findings suggest that incorporating video games into educational settings has the potential to capture students' attention and create an effective learning environment.

Table 56: General ranking 14-19 y.o.

In conclusion, the students expressed a strong preference for interactive and hands-on activities that allowed them to actively engage in the learning process. They showed enthusiasm for activities such as fairs/markets, experiments, debates, Living Labs, citizen science as these provided opportunities for collaboration, critical thinking, and practical application of knowledge. Artistic activities and storytelling were also appreciated for their creativity and ability to convey messages effectively. However, it was noted that preferences varied among individuals, with some students expressing less interest in certain activities. Overall, the findings highlight the importance of offering a diverse range of activities to cater to the varied interests and learning styles of the 14–19-year-old students, fostering their engagement and enhancing their educational experiences.

6.3.4.2 Pan-European: Conclusions for the 14-19 y.o. age group

Based on the results indicated in Table 48 and the feedback obtained from the teacher participants, an overall ranking of activities has been conducted. An overview of the highest ranked activities can be seen in the table below, as well as a conclusion on the proposed formats (see Table 57).

GENERAL RANKING 14-19 y.o.	
PROPOSAL	**COMMENTS**
1.Field Trips	Field trips present an opportunity to engage with the community, allows students to get engaged in experiential learning, to explore the outdoors and acquire information about life.
2.Challenges	Students think challenges spark enthusiasm and creativity, critical thinking and collaboration. Moreover, challenges allow working with real life problems and practicing skills developed in school.

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3.Podcasts	Students considered this format as a very effective way of communicating ideas and information, and it can be used in various subjects.

Table 57: General ranking 14-19 y.o.

Secondary school students selected formats that foster the connection with the world outside of classroom, to foster competition with collaboration and exchange of ideas. These choices allow them to make a more tangible and grounded connection with the real world, to learn from the experience and become more prepared for the world outside of classrooms. Taking part in challenges that are based on real-life issues and being involved in the problem solving and solution seeking process, provides them with a transferable set of skills that would allow them to apply their knowledge when the opportunity arises.

7. Appendix

7.1 Guideline for Living Labs

Annex 7.1_GenB_Guideline

7.2 Living Lab Reporting Template

Annex 7.2_GenB_Living lab

7.3 Living Lab Reports

7.3.1 Austria

7.3.1.1 Living Labs with 4-8-year-olds and 9-13-year-olds

7.3.1.1.1 Workshop 1

Annex 7.3.1.1.1_GenB_4-8 a

7.3.1.1.2 Workshop 2

Annex 7.3.1.1.2_GenB_4-8 a

7.3.1.1.3 Workshop 3

Annex 7.3.1.1.3_GenB_4-8 a

7.3.1.2 Living Labs with 14-19-year-olds

7.3.1.2.1 Workshop 1

Annex 7.3.1.2.1_GenB_14-1

7.3.1.2.2 Workshop 2

Annex 7.3.1.2.2_GenB_14-1

7.3.1.2.3 Workshop 3

Annex 7.3.1.2.3_GenB_14-1

7.3.2 Italy

7.3.2.1 Living Lab with 4-8-year-olds

Annex 7.3.2.1_GenB_Living

7.3.2.2 Living Lab with 9-13-year-olds

Annex 7.3.2.2_GenB_Living

7.3.2.3 Living Labs with 14-19-year-olds

Annex 7.3.2.3_GenB_Living

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7.3.3 Slovakia

7.3.3.1 Living Lab with 4-8-year-olds

Annex 7.3.3.1_GenB_Living

7.3.3.2 Living Lab with 9-13-year-olds

Annex 7.3.3.2_GenB_Living

7.3.3.3 Living Labs with 14-19-year-olds

Annex 7.3.3.3_GenB_Living

7.4 Inspirational formats for Living Lab with 4-8 and 9-13-year-olds in Austria

Annex 7.4_GenB_Living lab

7.5 Inspirational formats for Living Lab with 14-19-year-olds in Austria

Annex 7.5_GenB_living lab_

7.6 Save the date Common Ground Camp

Annex 7.6_GenB_Save the c

7.7 Agenda Common Ground Camp

Annex 7.7_Agenda_GenB_C

7.8 Guidelines for preparing and conducting the focus groups

Annex 7.8_DocA_GenB_Foc

7.9 Informed consent form

Annex 7.9_DocB_GenB_Foc

7.10 Material to develop the focus group for students aged 4-8

Annex 7.10_DocC1_GenB_F

7.11 Material to develop the focus group for students aged 9-13

Annex 7.11_DocC2_GenB_F

7.12 Material to develop the focus group for students aged 14-19

Annex 7.12_DocC3_GenB_F

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