GENB
YOUNG BIOVOICES FOR A SUSTAINABLE FUTURE

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GenB Policy recommendations

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OUR CONSORTIUM

APRE Agenzia per la Promozione della Ricerca Europea
btg biomass technology group
LOBA®
PEDAL CONSULTING
European Schoolnet
ZSI
aiju INSTITUTO TECNOLÓGICO DEL PRODUCTO INFANTIL Y OCIO
Q-PLAN INTERNATIONAL
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Abstract	This document provides a detailed overview of the policy recommendations targeting European Commission, Ministries of Education and other decision makers, teachers and educators, as well as Heads of Schools
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Table of Abbreviations and Acronyms

Abbreviation	Meaning
AIJU	**ASOCIACIÓN DE INVESTIGACIÓN DE LA INDUSTRIA DEL JUGUETE CONEXAS Y AFINES**
AllThings.Biopro	H2020 project, GA No. 887070, https://www.allthings.bio/
APRE	**Agency for the Promotion of the European Research**
AR	Augmented reality
BIObec	H2020 project, GA No. 101023381, https://biobec.eu/
Be-Rural	H2020 project, GA No. 818478, https://be-rural.eu/
BioBeo	https://www.biobeo.eu/
BioCannDo	https://www.allthings.bio/
BioGov.net	https://www.biogov.net/
BIOMODEL4REGIONS	https://www.biomodel4regions.eu/
BIOVOICES	H2020 project, GA No. 774331, https://www.biovoices.eu/
BIOWAYS	H2020 project, GA No. 720762, https://www.bioways.eu/
BLOOM	H2020 project, GA No. 773983, https://bloom-bioeconomy.eu/
BTG	**BTG BIOMASS TECHNOLOGY GROUP BV**
Circular Bricks	https://www.circularbricks.eu/
CPD	Continuing Professional Development
DG EAC	The Directorate-General for Education, Youth, Sport and Culture
DG ENV	The Directorate-General for Environment
DG RTD	The Directorate-General for Research and Innovation
EC	European Commission, https://commission.europa.eu/
EdTech	Education technology,
EU	European Union
EuBioNet	European Bioeconomy Network, https://eubionet.eu/
EUN	**EUN Partnership AISBL**
ESD	Sustainable Development
FVA	**FVA SAS DI LOUIS FERRINI & C**
GenB	Generation Bioeconomy
GreenComp	A reference framework for sustainability competences
HSPN	**HELLENIC SOCIETY FOR THE PROTECTION OF NATURE**
IBL	Inquiry-Based Learning
KBBE	The knowledge-based bio economy
LOBA	**GLOBAZ, S.A.**
MoEs	Ministries of Education
MOOC	Massive Open Online Course
OSOS	https://www.openschools.eu/
PEDAL	**PEDAL CONSULTING SRO**
PBL	Project-based learning

Q-PLAN	**Q-PLAN INTERNATIONAL ADVISORS PC**
Rural BioUp	https://www.ruralbioup.eu/
SDGs	Sustainable Development Goals
SLEs	https://www.steamecologies.eu/
STEM	Science, Technology, Engineering, and Mathematics
Skillbill	https://skillbill-project.eu/
TEDx	A specific type of TED conference
Transition2Bio	H2020 project, GA No. 101000539, **www.transition2bio.eu/**
VR	Virtual reality
ZSI	**ZENTRUM FUR SOZIALE INNOVATION GMBH**

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Executive summary

The GenB project co-created new formats, approaches, methods, tools and activities to engage young people across three age groups (4-8, 9-13, and 14-19 years-olds), as well as teachers, non-formal educators and multipliers, bioeconomy experts and other project stakeholders to educate them on bioeconomy, bio-based products, and career opportunities within the field. Findings from these sessions revealed preferred educational formats for each age group, highlighting insights for effective bioeconomy education methods. Included activities also aim to encourage teamwork and leadership in classrooms, positively shifting dynamics and promoting a deeper understanding of bioeconomy topics.

Bioeconomy is an economic system that uses biomass – renewable biological resources, such as plants, animals, and microorganisms – to produce goods, energy, and services. In education, Bioeconomy is considered as a very important and useful topic to introduce to students. Understanding the connection between education and bioeconomy, the GenB project worked towards educating and empowering students to become more aware, sensitive and interested in environmental issues, sustainability and circularity.

Based on the lessons learned through the different activities, GenB proposes recommendations for 1) European Commission, 2) Ministries of Education and other decision makers; 3) Teachers and Educators; 4) Heads of schools, to include bioeconomy, as part of the environmental sustainability in education activities in Europe. The recommendations for each group can be connected to five areas:

- Bioeconomy in the Curriculum: outlining what bioeconomy is, benefits of learning bioeconomy in school, curriculum reform and how it can be transformed
- Professional development of teachers and recognition
- Collaboration
- Resources on GenB: the type of resources, access to the resources, how the resources need to get the endorsement of the national government
- Technology and inclusion

The key recommendations for European Commission include:

- In view of the reshape of the European Bioeconomy Strategy, it is essential to send few clear signals to DG ENVI (The Directorate-General for Environment), DG RTD (The Directorate-General for Research and Innovation) and lastly to DG EAC (The Directorate-General for Education, Youth, Sport and Culture)
- Skills is one of the backbones of the European Bioeconomy strategy and we should remind it here for jobs and new enterprises of the future
- Last but not least, the importance of investing in STEM particularly addressing women

The key recommendations for Ministries of Education and other decision makers:

- Support and optimise curriculum reform for the inclusion of green education
- Create national CPD (Continuing Professional Development) programs and recognize courses for CPD national requirements
- Improve access to resources and tools and endorse repositories and include in national resources
- Provide guidance for schools to create the space and time for collaboration and endorse practice networks

- Support the uptake of new technologies to enhance teaching and improve inclusion

The key recommendations for teachers and educators are the following:

- Make use of ready-to-use tools and resources that foster bioeconomy teaching and learning
- Focus on skills and competences

And the key recommendations for heads of schools include:

- Shape an enabling environment for bioeconomy
- Promote long-term school project

The recommendations listed above are supported by several key outputs developed by the GenB project. A few examples of useful outputs connected to the recommendations are highlighted in the Table 1.

Table 1: GenB outputs supporting the recommendations

Output	Link to the output	Recommendation
GenB Report on co-design activities'	D1.2 REPORT ON CO-DESIGN ACTIVITIES | GenB	Support and optimise curriculum reform for the inclusion of green education
GenB Virtual Library	GenB	Improve access to resources and tools and endorse repositories and include in national resources; Make use of ready-to-use tools and resources that foster bioeconomy teaching and learning
GenB MOOC, various events	MOOC Bioeconomy for Educators: Cultivating a Sustainable Future | GenB, Events | GenB	Create national CPD programs and recognize courses for CPD national requirements; Make use of ready-to-use tools and resources that foster bioeconomy teaching and learning
GenB Toolkits	Toolkits | GenB	Support the uptake of new technologies to enhance teaching and improve inclusion; Make use of ready-to-use tools and resources that foster bioeconomy teaching and learning
GenB Ambassadors	Ambassadors | GenB, Materials for GenB Ambassadors | GenB	Provide guidance for schools to create the space and time for collaboration and endorse practice networks Make use of ready-to-use tools and resources that foster bioeconomy teaching and learning

1. Introduction

The GenB project aimed to inspire young people to adopt sustainable and circular lifestyles. By engaging young people, parents, and teachers, GenB developed and provided materials and toolkits on the bioeconomy and bio-based sectors.

This report contains two parts: The first part builds on the various previous reports produced under the project and focuses on the general background of the project and its main achievements, including valuable insights from teachers and students. In addition, this first part includes a description of bioeconomy and its connection to EU Competences, the pedagogies behind and STEM[1] teaching and learning. The second part of the report concentrates on the policy recommendations which refer to the key considerations turned into actions for Ministries of Education (MoEs) and other decision makers, as well as practitioners like educators and heads of schools.

The recommendations are based on the lessons learned from educational activities, events and tools embraced by the GenB project, including:

(i) integration of bioeconomy education in the existing school system

(ii) support stakeholders in adopting bioeconomy related curricula

(iii) promote new approaches for bioeconomy education through incentives, infrastructures, capacities and policies.

The aim of the recommendations is to provide solutions to improve and expand bioeconomy in education in European contexts Therefore, the purpose of this document is to help the European Commission, MoEs and other decision makers, Teachers and Educators as well as Heads of Schools to understand how they can support the integration of bioeconomy into their educational landscape. Through the recommendations, GenB will support relevant stakeholders in the implementation of “whole school approaches”, embedding bioeconomy and learning for environmental sustainability across the whole school institution, through a cross-sectoral approach and stronger cooperation with a wide range of stakeholders. The aim of this approach is to foster the development of essential STEM skills and knowledge in pupils across Europe.

These recommendations are based on the outcomes of the two workshops conducted with MoEs (see Appendix Outcomes of the two workshops with MoEsfor more information), as part of this report. They are further complemented by targeted bioeconomy-specific recommendations, resulting from other GenB events.

2. The GenB project and bioeconomy in education

About the project

Launched in November 2022, GenB is a 30-month project, funded by Horizon Europe, the European Union’s funding program for research and innovation. It is focused on educating and empowering the Generation Bioeconomy (GenB), aware, sensitive, and interested in environmental issues, sustainability and circularity. It aims to raise awareness on Bioeconomy building on communication and education that encourage and reward young BIOVOICES to take

[1] Science, Technology, Engineering and Mathematics.

a role in steering the transition towards more sustainable lifestyles. The project contributes to the implementation of the updated 2018 EU Bioeconomy Strategy [1] and the European Green Deal [2] priorities, as well as to the achievement of a climate-neutral Europe by 2050 and the Sustainable Development Goals (SDG) [3] and quality education, involving: the most relevant awareness and education EU funded projects and initiatives (Transition2Bio, BioBeo, Skillbill, Circular Bricks, BIObec, BIOMODEL4REGIONS, BioGov.net, AllThings.Biopro, Rural BioUp, BLOOM, BIOVOICES, BIOWAYS, Be-Rural, BioCannDo, EuBioNet), a wide European and International school networks and experts in socio-economic science and humanities.

It is documented that education for the bioeconomy is conceptually related to the attainment of the SDGs and ESD (Sustainable Development).

The project co-created new formats, approaches, methods, tools and activities to engage young people across the three age groups targeted by the project (4-8, 9-13, and 14-19 years old), as well as teachers, bioeconomy experts and other project stakeholders such as: Living Labs, Common Ground Camp, Focus groups, hands-on labs, Bioeconomy Villages, BioArt Gallery, role-playing games, career info-days, TEDx pitches, a MOOC as well as the interactive workshops and informative webinars for educators

These activities aimed to educate participants on bioeconomy, bio-based products, and career opportunities within the field. Findings from these sessions revealed preferred educational formats for each age group, highlighting insights for effective bioeconomy education methods. Included activities also aim to encourage teamwork and leadership in classrooms, positively shifting dynamics and promoting a deeper understanding of bioeconomy topics.

Both teachers and students recognise the importance of bioeconomy for a sustainable future, despite limited prior knowledge. Findings emphasise collaborative, group-based, and hands-on activities, as well as gamified experiences as effective to foster both engagement and learning about bioeconomy. Based on the results of these activities, range of materials for wide audiences have been developed and tested. These outcomes highlight the value of hands-on, collaborative, and well-supported bioeconomy education for younger generations. For effective and impactful scaling, policy support is recommended to extend these practices across EU educational systems, allowing ample time and resources for sustainable development initiatives. All the above-mentioned activities are described in detail in previous deliverables produced as part of the project.

As a result of the co-creation activities with different audiences five toolkits were developed and translated into eight European languages, including resources for use by young people, teachers, and other stakeholders, all aimed at fostering bioeconomy education and awareness. The five toolkits alongside bioeconomy awareness resources and educational materials, have been included in materials section hosted on the GenB website. Further details on the toolkits are provided in D1.3 Toolkits for young people, teachers and other multiplayers.

The toolkits include different immersive and interactive tools to effectively engage wide audiences, in different educational settings, by providing hands-on and real-life experiences with bio-based products that stimulate all senses. Educational tools for teachers, such as the GenB Toolkits, enable educators to effectively incorporate bioeconomy topics into curricula. They benefit from workshops and training sessions, where they explore materials and brainstorm integration into their lessons.

Building on innovative approaches co-created in the initial phase of the project, to foster the engagement and empowerment of young people, GenB had gathered a network of like-minded and environmentally conscious group of young GenB Ambassadors, who play a crucial role in mobilizing their communities. To promote bioeconomy awareness and education, many of the interactive activities and educational tools implemented, were tested with and promoted to GenB Ambassadors, engaging various audiences and fostering sustainability education.

Apart from the activities and tools mentioned, another outcome of the project is the GenB education model[2] developed with an aim to support public administrations and schools in implementing initiatives promoting the bioeconomy transition process. The model provides guidelines and recommendations on how to build knowledge about bioeconomy. Central to the model is also development of skills and attitudes of students, necessary to educate the Generation Bioeconomy (GenB), aware, sensitive and interested on environmental issues, sustainability and circularity.

About Bioeconomy and its role in education

The term bioeconomy seems to have been used already in the early 2000s [4]. However, the foundations for the bioeconomy come from previous strategic agendas of the European Commission (EC). In 2005, at the international conference of the European Union, the knowledge-based bio economy (KBBE) framework was presented, followed by another conference in 2007, which outlined the prospects for the European bioeconomy over the next 20 years. These two events contributed to the emergence of the knowledge-based bioeconomy in European policy circles [5].

Bioeconomy is an economic system that uses biomass – renewable biological resources, such as plants, animals, and microorganisms – to produce goods, energy, and services. It covers a broad range of sectors, from agriculture, fishery, and forestry to bio-based and traditional industries, biorefineries, and (bio) energy. It encompasses all sectors and associated services and investments, that produce, use, process, distribute or consume biological resources, including ecosystem services [6].

In education, Bioeconomy is considered as a very important and useful topic to introduce to students. Understanding the connection between education and bioeconomy, GenB project works towards educating and empowering students to become more aware, sensitive and interested in environmental issues, sustainability and circularity.

To understand how to implement bioeconomy topic in their activities and lessons, educators need to use several pedagogical approaches such as Inquiry-Based Learning (IBL) and Project-based learning (PBL), Experiential Learning, Differentiated Instruction.

Bioeconomy is connected to different European Competences, while many of them are crucial in education. For example, to support the skills learners will need for the green and transition to the more sustainable lifestyles, the European Commission (EC) has developed the European Sustainability Competence Framework, called 'GreenComp' [7]. Developed by the Joint Research Centre of the European Commission, the framework identifies a set of sustainability competences that can be integrated into educational programs with the aim to help learners acquire knowledge, skills, and attitudes that encourage empathetic, responsible, and caring

[2] Reference will be included once the link is available.

thinking, planning, and action towards the planet and public health. This focus on action aligns with the GenB project's objective to empower youth as Bioeconomy Ambassadors and in a variety of school initiatives presented in the GenB MOOC, encouraging them to take initiative and advocate for sustainable practices within their communities.

Several of the competencies included in the GreenComp framework are covered also in the 21st Century Learning Framework [8]. Through the holistic approach to sustainability, the framework addresses the interconnectedness of environmental, social, and economic dimensions of sustainability. This holistic view is essential for the GenB project, which seeks to educate young people about the complexities of the bioeconomy and its implications for sustainable living.

Digitalisation has a strong influence on the implementation of bioeconomy. Therefore, digital competences are also considered crucial into the educational system to effectively teach green competences. Organised in 5 areas, the framework details how digital technologies can be used to help educators engage confidently, critically and safely with them [9]. Building educators' capacity to use digital tools is essential to help them support students acquire the sustainability skills they need. More info on GreenComp and pedagogies/learning approaches can be found in the D4.4 GenB Education Model- reference to Education Model.

Bioeconomy and integrated STEM teaching: most processes, ideas and things in the world cannot be explained through a singular approach. For example, many natural systems - such as the Earth's climate – cannot be fully understood and investigated without an interdisciplinary approach. An interdisciplinary approach relates to more than one category of knowledge. It refers to teaching across multiple subjects, by incorporating knowledge and skills them to enrich the overall educational experience.

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

Bioeconomy from a whole school approach: in bioeconomy, as well as in any other topics, educators should not take action alone, but in collaboration with various stakeholders (school community, including school principals, parents, other schools, industries, research students) and sectors in STEM teaching. For example, involving the community, especially **parents,** in school events and projects can help to foster the development, as well as reinforcement of more sustainable habits and choices. Moreover, establishing partnerships with other schools enables sharing of resources, ideas, and successes, creating a larger network of support and innovation.

Some projects such as OSOS and SLEs require the cooperation of educators with different stakeholders and breaking the boundaries of a specific school setting or subject.

Urmetzer et al. (2020) highlight that pedagogical approaches based on education for sustainable development (ESD) that are interdisciplinary can support transformational bioeconomy education processes [10].

3. Policy recommendations for EC, MoEs and other decision makers, Teachers and Educators, Heads of schools

In this section we share recommendations from the GenB project based on the lessons learned through the different activities and events developed as part of the project. It is important to note that highlights from the GenB EU Policy workshop **"What's Next for Bioeconomy Education?"**, together with the takeaways from the GenB workshops with the MoEs were presented in the EC high level event for the revision of the Bioeconomy Strategy "***Bioeconomy education to enable the transition to a competitive, regenerative, and fair (bio)economy. Building the next union of skills in the bioeconomy***" on 20 November 2024.

The recommendations are addressed to 1) European Commission, 2) Ministries of Education and other decision makers; 3) Teachers and Educators (working in both formal and non-formal education contexts); 4) Heads of schools. The recommendations for each group can be connected to five areas:

- Bioeconomy in the Curriculum outlining what bioeconomy is, benefits of learning bioeconomy in school, curriculum reform and how it can be transformed
- Professional development of teachers and educators and recognition
- Collaboration
- Resources from GenB: the type of resources, access to the resources, how the resources need to get the endorsement of the national government
- Technology and inclusion

Recommendations for the European Commission

- In view of the reshape of the European Bioeconomy Strategy, it is essential to send few clear signals to DG ENVI, DG RTD and lastly to DG EAC.
- Skills is one of the backbones of the European Bioeconomy strategy and we should remind it here for jobs and new enterprises of the future.
- Last but not least the importance of investing in STEM particularly addressing women.

Recommendations for Ministries of Education and other decision makers

At the European level, and considering the specificities of each country in terms of curricula and educational goals, a set of recommendations are proposed:

Support and optimise curriculum reform for the inclusion of green education from early ages

Environmental education supports sustainability and pedagogical changes (Green and Digital Transitions, GreenComp, SDGs). Green Education also helps achieve a range of STEM and non-STEM learning objectives. The recommendation would be to support and optimise curriculum reform for the inclusion of green education (and bioeconomy specifically) from early ages (including Early Childhood Education and Care, and primary education). A few examples of successful national curriculum reforms incorporating bioeconomy and sustainability include the ones developed in Finland and Germany. More information about various national curriculum reforms is available through the EC portal.

Create national CPD programs and recognize courses for CPD national requirements

Teachers need knowledge and training to gain confidence in introducing environmental subjects in class. The implementation of GenB project activities has demonstrated that a teacher's willingness to engage in bioeconomy education is directly correlated with their level of knowledge of bioeconomy and how it connects to other sustainability topics. There are courses for teachers, such as: GenB training contents, GenB massive open online course (MOOC): 'Bioeconomy for Educators: Cultivating a Sustainable Future' or capacity building webinars conducted in national contexts for teachers and educators that contribute to teachers' professional development and allow them to explore new teaching methods, such interdisciplinary approach, project-based learning, whole school approach, etc. Additionally, it is important to recognize teachers for the time and energy they spend on their own development and therefore welcome activities which impart knowledge but also grant them certificates of recognition and collaboration with peers from different schools and countries. Therefore, Ministries of Education can support the uptake of green education by consolidating the validity of bioeconomy trainings for national CPD requirements and the recommendation would be to create national CPD programs, on recurring basis, for educators on how to introduce bioeconomy into their teaching.

Connected to the above, MoEs should recognize courses for CPD national requirements. Sustainability related professional development programmes could become an integral part of teachers' portfolio, ensuring all educators have at least basic knowledge on the topic. One of the possible solutions could also be "thematic expertise recognition" which STEM School Label offers to schools. STEM School Label is a Scientix® initiative that aims to guide schools in increasing students' interest and skills in STEM subjects and provide schools with the necessary tools to engage their students, teachers and other actors in related activities by developing an appropriate STEM strategy.

The support for such specific development programmes as the STEM School Label could be paired with national mentorship programmes to act as an amplifier and encourage new schools and teachers to join the green education movement. Expert teachers, schools and mentors could initiate and provide training, along with networking opportunities.

Improve access to resources and tools and endorse repositories and include in national resources.

Teachers need trustworthy resources to help them integrate new topics in class at all levels of education. Resources need to be adaptable and flexible. The recommendation would be to improve knowledge about existing resources (science education toolkits and materials) coming from EU-projects, improve access to resources and tools and endorse repositories and include in national resources.

Provide guidance for schools to create the space and time for collaboration and endorse practice networks

Peer support and encouragement are key in motivating students and educators to engage in experimental and exploratory teaching methodologies. It is therefore essential for MoEs to create the space for peer support to take place. Educators need to be encouraged to innovate and introduce new topics such as bioeconomy and pedagogies. Schools therefore need to create the time and opportunities for interdisciplinary learning experiences. The recommendation would be to provide guidance for schools to create the space and time for collaboration and

endorse practice networks. Such collaborations offer real world examples, contextualised learning, and a realistic first-hand account of the bioeconomy. Teachers with experience on bioeconomy projects showcased the benefits of such collaborations during the MOOC (see the previous section) and the different workshops organised within GenB. Additionally, GenB Ambassadors engaged various audiences and promoted sustainability education. In doing so, the Ambassadors took the initiative and advocated for sustainable practices within their communities.

MoEs should support the development of local networks where educators can exchange good practices in their own language. Collaborations with the educational community such as families and parents is also needed to support informal education at home Additionally, collaboration with experts in the field of bio-based sectors (such as entrepreneurs, research centers) in order to support the acquisition of complex scientific topics and processes such as bioeconomy and act as role models for future STEM careers is crucial. Therefore, aligning the school communication with the bio-based sectors while harmonising requisite skill sets stands as a pivotal endeavour. Through storytelling, classroom discussions, activities connected to real life (e.g. Living Labs), field trips (e.g. "a day in a biorefinery activity) hands-on workshops and practical insights, professionals make complex topics such as bioeconomy accessible, help clarify career pathways and show that bioeconomy is an interdisciplinary field accessible to diverse backgrounds beyond STEM. Engaging relatable speakers, particularly for older students nearing career decisions, helps contextualise the field, resolve any misconceptions, and inspire interest in bioeconomy-related careers. Career info days also serve as a valuable guide, as students often struggle to find information on their own about bioeconomy opportunities and pathways connected to their studies.

Support the uptake of new technologies to enhance teaching and improve inclusion

New technologies in general (e.g. AR/VR, online tools, EdTech, etc) and those connected to the bioeconomy in particular (e.g. online games about bioeconomy, podcasts, online courses for both teachers and students such as MOOC for teachers or Capacity building for Ambassadors, all developed within GenB) contribute to the creation of new and immersive learning experiences that can overcome geographical barriers and support modern learning objectives. The recommendation would be to support the uptake of these technologies to enhance teaching and improve inclusion.

Recommendations for Teachers and Educators

The recommendations for teachers and educators to better integrate environmental education in general and bioeconomy in particular include:

Make use of ready-to-use tools and resources that foster bioeconomy teaching and learning

A wide range of educational materials on the bioeconomy is available for teachers and educators. There is no need to start from scratch, but access repositories like the GenB Virtual Library or CLEVERFOOD toolkit.

Focus on skills and competences

The acquisition of skills and competencies such as practical proficiency, problem-solving ability, and a strong collaborative ethos should be promoted in schools to meet the demands of the bio-based industries.

Recommendations for Heads of Schools

School management, and Head of Schools in particular, have a significant role to play in the mainstreaming of bioeconomy learning and teaching. The recommendations for Heads of Schools include:

Shape an enabling environment for bioeconomy

Heads of schools should reconsider time allocation and management and strive to strike the best balance between structure and flexibility in daily, weekly, and annual schedules within schools to give the opportunity to teachers to work together for designing and implementing lesson plans for bioeconomy integration. On top of the above aspects, school administrations should look to extend the enabling environment for bioeconomy integration to school neighbourhoods through strategies like the open schooling approach, building long-lasting synergies and ecosystem hubs with other schools and stakeholders.

Promote long-term school projects

School projects of a longer duration are more likely to promote bioeconomy in the class. Heads of schools should encourage the design and implementation of bioeconomy projects by teacher teams. Also, the projects ran in schools on bioeconomy should be sustainable and therefore, a funding and support is needed. The Heads of Schools may encourage teacher teams through programmes to apply for funds and initiate bioeconomy-related projects.

Another option to consider is that each new project should build on the learning experiences of previous projects. In addition, project-based learning at each school may capitalize on the perspective of learning progressions, which are designed to enable the accumulation of student knowledge and skills in specific topics of the curriculum across different grades. In addition, projects should be integrated and mainstreamed in curriculum and not act as stand-alone projects which may overburden teachers.

4. Conclusions

As a result of the lessons learned, good practices and recommendations for the European Commission, MoEs and other decision makers, Teachers and Educators as well as Heads of Schools presented in this report, the educators and young learners can be equipped with the necessary knowledge and skills, making them more aware, sensitive and interested in environmental issues, sustainability and circularity. It is not expected that all recommendations will be implemented immediately or/and simultaneously. Nevertheless, the lessons learned from projects like GenB can contribute to the advancement of environmental sustainability education, with a special focus on bioeconomy, providing some suggestions of changes in both attitudes and policy and contributing for example to making information on the EU Bioeconomy and EU Bioeconomy Strategy more widely available and easier to access as recommended by the European Commission.

All the materials created by GenB will remain available through the GenB website, as well as different platforms, including Scientix, the community for science education in Europe, and everybody is welcome to take them and use them, adapt them and further enhance them.

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6. Appendix Outcomes of the two workshops with MoEs

SCIENTIX® MINISTRIES OF EDUCATION STEM REPRESENTATIVES WORKING GROUP ONLINE WORKSHOP

POLICY BRIEFS IN STEM EDUCATION: DESIGNING BETTER POLICY SUPPORTING DOCUMENTS FOR MINISTRIES OF EDUCATION

Tuesday 3 September 2024

Introduction

Policy supporting documents are essential for projects and are commonly required by EU funding bodies. They use different formats, such as **reports on policy recommendations, policy briefs and policy digests**, depending on the aim and the target audience of the document. Likewise, it is crucial for the **Ministries of Education** (MoEs) to get the latest findings from **EU-funded STEM projects** to support their policy work.

The online workshop "Policy Briefs in STEM Education" co-organised by Scientix® and the GenB and Life Terra projects was held to discuss and define the format of policy briefs and what they should contain in order to meet the needs and plans of MoEs. The workshop was open to members of the Scientix Ministries of Education STEM representatives Working Group[1] and their guests. 20 participants from 15 different Ministries of Education attended the workshop[2].

To inform the discussion, participants were introduced to the **policy supporting documents** currently being developed with the support of Scientix for different EU-funded projects, namely:

- The **Report on Policy Recommendations**[3] (example taken from The EU4Ocean Coalition) provides an in-depth exploration of academic and policy considerations and presents recommendations for differentiating and enriching curricula. The most comprehensive of the policy supporting documents, the report is also the longest, frequently running to over 10 pages.
- The 'EC' Policy Brief (example taken from the SEER – The STE(A)M Education European Roadmap project), a short and general document (about 5/6 pages) based on a template provided by the European Commission. With fixed headings but flexible content, its greater simplicity makes it suitable for a wider audience.
- The Policy Digest (example taken from the SLEs – STE(A)M Learning Ecologies project), a two-page overview valuable for teachers and the general public, but not intended for those who require detailed or contextualised information.

GenB and LifeTerra, the projects leading the workshop to see how they could develop policy documents for them, presented their key activities that will feed their policy recommendations.

- The EU-funded GenB project aims to educate and empower the Generation Bioeconomy. Through co-creation and cooperation with young people and other multipliers, the project provides formats and materials to inspire and foster the transition towards a more sustainable lifestyle. Through the presentation, the project representatives reflected upon developed materials and the implemented activities (such as teacher training sessions, awareness raising events, hands-on labs and study visits), as well as 6 toolkits with teaching various materials available in nine languages, intended for various

[1] The Scientix Ministries of Education Science, Technology, Engineering and Mathematics (STEM) representatives Working Group (MoE STEM WG) is a platform of discussion and exchange for Ministries of Education regarding their STEM education policies. European Schoolnet coordinates the working group and MoEs are responsible for appointing the members
[2] Belgium (Flanders), Croatia, Cyprus, Czech Republic, Finland, France, Greece, Italy, Luxembourg, Malta, Portugal, Serbia, Spain, Switzerland and Türkiye.
[3] Document under review.

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GenB, Life Terra, SLEs and the SEER are funded by the European Commission (EC). The content of the document and the workshop are the sole responsibility of the organizer, and it does not represent the opinion of the EC, and the EC is not responsible for any use that might be made of the information contained. Scientix®, the community for science education in Europe, is an initiative of European Schoolnet.

audiences (such as teachers, students aged 4-19 and other multipliers). Finally, the GenB Virtual Library, which offers a great number of resources along with the ones presented, was introduced.

- Tree planting is the best way to capture carbon. This mechanism contributes to the fight against climate change and stops the devastation caused by deforestation, droughts, floods and heat waves. Life Terra is trying to plant 500 million trees in Europe and use nature's own carbon capturing system to get people to act against the climate crisis. This project was presented on the basis of its core principles (tree planting, tree monitoring, education and community) and a detailed explanation of different strategies to raise awareness of the environment, especially among children and young people: the Guide for School Plantings, the Terra Educational Pack and the Terra Mission MOOC. An emphasis was placed on outlining the achievements of these strategies.

Outcomes

Following the materials and projects presented, the participants brought up and agreed that:

Categorisation and key messages are essential to disseminate the various EUN policy documents

Some participants (*Türkiye*, *Finland* and *Malta*) confirmed that they share the policy documents with their policy colleagues and other relevant networks of professionals, such as researchers and teacher training networks. Participants explained that the distribution is ad hoc, based on the interest of their contacts for the topic of the policy document. They emphasised that using a clear categorisation of the topic and content of the document is essential for them to direct the resources appropriately, along with highlighting clearly the key messages and potential uses of the document.

MoEs Representatives also pointed out that in order to be able to contextualise project results, it is also necessary to know the processes and steps in which different projects are involved in order to achieve these results. This information should be presented as concisely as possible.

The use of one type of policy supporting document over another will depend on the target audience. The consensus reached by all participants was that all formats of policy supporting document are valid when they are matched to the appropriate target audience. For example, participants from *Croatia*, *Portugal* and *Italy* stated that the shorter format (Digest) is more suitable for teachers, when documents that offer detailed background are useful to explore policy and pedagogies in depth. In addition, the participant from *Luxembourg* commented that the Digest is useful to get a first impression of the topic and to decide whether it is interesting enough to continue with the more detailed Report.

One of the participants (*Türkiye*) pointed out that for certain audiences, such as teachers, a video format could be an effective way of sharing information, like what GenB does with video interviews of its job profiles. Such kind of alternatives could be considered, but the final assessment was that documents, whether more or less comprehensive, are always needed.

Policy supporting document should be practical and offer real cases

All participants agreed that policy supporting documents can be shared with policymakers to inform policy decisions, but practical recommendations must coincide with curriculum reform to be actionable. Therefore, it is key that policy supporting documents offer evidence-based information that can support policymaking and help connect EU-level policy with national circumstances.

On the other hand, one participant from *Croatia* pointed out that policy related documents can also be useful for teachers to help them understand their own national policies, while also discovering EU-funded resources and new topics. However, given the potential for confusion, policy documents could be made more teacher-friendly by producing joint documents across projects that help centralise and streamline the information.

Shared outputs with MoE STEM WG Representatives should be targeted at teachers and concise

A participant (*Cyprus*) pointed out that it is relatively straightforward for MoEs to communicate all relevant information to teachers, thanks to the networks and contacts in teacher training groups. Therefore, participants indicated that it is important for projects to share their teacher targeted outputs with the MoE STEM Working group representatives. However, for such information and resources to be actionable, one of the participants (*Finland*) stressed that projects results need to be presented in as concise a way as possible in order to reach teachers more effectively.

During the discussion, one of the aspects highlighted was the importance of establishing some kind of system to display the different projects results in a clearer way to the MoEs. One of the participants (*Switzerland*) remarked that, given the large number of projects, presenting general updates for each project may be too confusing and complicated, so the consensus was to concentrate on concrete outputs of each project, preferably through precise examples.

These outputs should be appropriately classified through different categories or keywords (e.g. subject areas, specific criteria as in the case of the STEM School Label, or key competences) and ideally adapted to the reforms and characteristics of the education system in each country in order to provide the most convenient information for teachers.

EUN policy documents could help link EU and national policy levels

Some participants emphasised the importance for policy documents to brings some perspectives on EC policy for teachers and policymakers alike, indicating the need to relay and "translate" EU STEM education policies, trends, and priorities for various stakeholders. Participants welcomed this idea, but noted its complexity.

Conclusions and next steps

The discussion confirmed the value of the evidence-based policy support that projects can provide to the Ministries of Educations, offering some new ideas for targeted delivery that will help projects like GenB and Life Terra deliver valuable support to Ministries. Looking ahead, policy supporting documents must offer substantial background (topic, policy, pedagogy), give insights that help contextualise educational policy for teachers and offer broad perspectives that can help teachers find their way in the busy landscape of EU-funded projects and initiatives

This workshop will be complemented by a second discussion with Ministries of Education on policy recommendations on bioeconomy, oceans and trees in education. With a focus on connecting STEM education to global challenges and facilitating STEM educator exchange and peer learning, this upcoming workshop, which will take place November 2024, will be organised by GenB, Life Terra and EU4Ocean. These projects will present their results so that the Ministries of Education can comment on the results during this workshop.

More information

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SCIENTIX® MINISTRIES OF EDUCATION STEM REPRESENTATIVES WORKING GROUP

ONLINE WORKSHOP

POLICY RECOMMENDATIONS ON BIOECONOMY, OCEANS AND TREES IN EDUCATION

Tuesday 5 November 2024

Introduction and Summary

Policy recommendations, based on the findings of STEM projects, help **policymakers and stakeholders** to make informed decisions about the future of **STEM education** in Europe. As formal education depends on **Ministries of Education** (MoEs), it is crucial to share the results and recommendations with them to ensure that any solutions meet their needs properly.

The online workshop "Policy Recommendations on Bioeconomy, Oceans and Trees in Education" co-organised by the GenB, Life Terra and EU4Ocean projects was held to present the **lessons learnt and results** from these three projects and to discuss with the MoEs how to deliver **actionable policy support**.

This workshop was open to members of the **Scientix Ministries of Education STEM Representatives Working Group**[1] and their guests. 10 participants from 9 different MoEs attended the workshop[2], which showcased the impact to date of the results and lessons learnt from the three environmental education initiatives and discussed with the MoE representatives how these resources can be incorporated into their respective educational paradigms.

Building on the discussion from a previous workshop[3], where we explored the length, depth, and format of policy recommendations and other policy background documents, this event moved on to highlighting the common policy considerations and challenges impacting the introduction of environmental subjects into the practice of European teachers.

From the need for trustworthy knowledge and accessible resources to quality professional development offerings, teachers across Europe face the same needs and challenges when introducing new pedagogies and topics into their teaching. In this dynamic discussion, we explored how Scientix® and the projects can help policymakers support their teachers. The workshop shed light on curriculum design and reform processes and on the need and opportunities for official endorsement and recognition of resources and Continuous Professional Development (CPD) offerings.

We summarise the core findings below:

- Education reform processes are country-specific and often involve a political component. Policy recommendations therefore need to account for national and regional specificities and be adaptable.
- It is key to depoliticise environmental education by contextualising it at supranational level and aligning it with competences and international agendas. One important way of promoting the project and its products is by contextualising them within EU and International Political and Pedagogical

[1] The Scientix Ministries of Education Science, Technology, Engineering and Mathematics (STEM) representatives Working Group (MoE STEM WG) is a platform of discussion and exchange for Ministries of Education regarding their STEM education policies. European Schoolnet coordinates the working group and MoEs are responsible for appointing the members.
[2] Belgium (Flanders), Cyprus, France, Israel, Italy, Malta, Portugal, Spain and Switzerland.
[3] https://www.scientix.eu/news/news-detail?articleId=1827936.

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GenB, Life Terra and EU4Ocean are funded by the European Union. Views and opinions expressed in this document are however those of the author(s) only and do not necessarily reflect those of the European Union or the granting authority. Neither the European Union nor the granting authority can be held responsible for them. Scientix®, the community for science education in Europe, is an initiative of European Schoolnet.

ambitions, not only the European Sustainability Competence Framework (GreenComp) and Sustainable Development Goals (SDGs), but also the European Framework for the Personal, Social and Learning to Learn Key Competence (LifeComp) or the Digital Competence Framework for Citizens (DigComp).

- Policy recommendations must be understandable to teachers and highlight resources that schools and policymakers can pass on or add to National repositories, frameworks, etc.
- Teacher training initiatives, networks and groups can make an important contribution to taking reforms forward and are crucial for making available the products, resources and tools of projects.
- Teachers' and students' perspectives are valuable in curriculum design.

The valuable insights from the workshop will serve to refine the design of the projects' policy supporting documents and recommendations due in 2025. These results will also provide the foundations for the review and mainstreaming of all future Scientix® Policy Documents.

Read on for a more detailed account of the workshop.

Overview of the lessons learned from the GenB, Life Terra and EU4Ocean projects

At the beginning of the workshop, GenB identified three main areas of focus in terms of lessons learned, which are:

- **Bioeconomy in the Curriculum and Resources**: Teaching sustainable bioeconomy principles to foster awareness.
- **Collaboration**: Working with educators, students and professionals to enhance learning and real-world application.
- **Teacher Professional Development**: Offering continuous learning to empower educators with new skills and teaching strategies.

Firstly, the project presented key insights from students and teachers, gathered through a consultative process in which they were asked about their perceptions of the bioeconomy in an academic context, as well as the resources they found most useful.

Overall, the students displayed a notable level of interest and comprehension. They expressed considerable enthusiasm for learning about a circular bioeconomy and experimenting with bio-based products, indicating a clear recognition of the significant role this field plays in ensuring a sustainable future. In particular, students in Year 4 and above demonstrated a deeper knowledge of the bioeconomy, encompassing not only its economic and environmental dimensions, but its business implications as well.

LifeTerra continued by explaining the benefits of the activities undertaken by the project and presented at the previous workshop: the Guide for School Plantings, the Terra Mission Educational Pack and the Terra Mission MOOCs. To this end, the project representative introduced the Background Document. This document not only outlines such initiatives, but also provides an overview of research and evidence on best practice and success factors for increasing impact on student learning outcomes and engagement. It also includes an analysis of the alignment of these activities with GreenComp.

Based on these results, the project concluded by outlining potential ideas for the implementation of a series of plans related to sustainability and outdoor learning at national and regional levels, and for both schools and educators.

Presenting some resources developed by the Network of European Blue Schools in collaboration with Scientix, such as the Science Project Online Workshops (SPOWs) and the Bring the Ocean into Your School Massive Open Online Course (MOOC), the EU4Ocean project highlighted some key considerations and future actions to mainstream ocean knowledge in education. In addition to introducing ocean literacy into the

curriculum, it is also important to provide training for teachers so as to create a community of experts who can promote blue initiatives, and to improve the accessibility of materials for students.

Discussion on delivering actionable policy support

The key takeaways from the previous workshop on policy recommendations were briefly introduced to facilitate discussion:

- Specific policy recommendations must coincide with curriculum reform to be actionable
- Background information about the topic, policy landscape and curriculum analysis are useful components to support policy stakeholders
- Supporting the dissemination of tools and CPD offering is also an opportunity for policy stakeholders to support teachers
- Policy stakeholders also need concise summaries to quickly assess the value of the information, where to forward it, to whom, etc.

Following an illustration of how these outcomes can be achieved and an overview of the types of policy-supporting documents (Report[4], Policy Brief and Policy Digest), participants shared their views and perspectives on curriculum design and processes, the need for resources and training, and how to ensure the inclusion of Green and Blue Education in curriculum reform.

Takeaway 1: Education reform processes are country-specific and often involve a political component. Policy recommendations therefore need to account for national specificities and be adaptable.

All participants concurred that curricular reforms are influenced by factors that are particular to each nation, and that policy recommendations should be flexible in format and content to adapt to this diversity of scenarios and contexts.

The processes and design of curriculum reform vary in terms of consultation and involvement across countries. Some processes are driven by political agendas, some by experts and some involve schools, teachers or students. For example, the participants from *Israel* and *France* shared how national priorities can influence the way in which educational priorities are defined. Participants from both *Cyprus* and *Spain* highlighted the challenges of integrating reforms for these reasons, emphasising the need for policy recommendations and supporting documents that take account of teachers' and pupils' perspectives. Similarly, the participant from *Switzerland*, stated that the reforms must be adapted to the specifications of each region.

The necessity for adaptability in policy recommendations was further supported by the Belgian participant from *Flanders*, who elucidated that umbrella organisations (associations of school boards and governing bodies) are the entities responsible for liaising with the government to define the curricula and lessons. This structural diversity and specific national circumstances clearly illustrate why policy recommendations and other supporting documents should be adaptable and flexible.

Takeaway 2: Policy recommendations must be understandable to teachers and highlight resources that schools and policymakers can pass on or add to National repositories, frameworks…

The participants agreed that the policy recommendations should be sufficiently transparent to enable teachers to understand their influence on their work practice. In addition, teachers from certain countries may have the prerogative to implement some changes directly without amending the curriculum. It is

[4] Document under review.

therefore important that policy documents also address practitioners and include an overview of key resources and tools for the classroom and for CPD.

In relation to this, the participant from *Spain* expressed that resources such as those presented during the workshop could be transferred to regional bodies with a view to defining future educational reforms. Additionally, participants accentuated the value of repositories in terms of understanding the scope of the projects and their outputs. On this point, attendees from both *Israel* and *Switzerland* highlighted their importance by presenting the existence of a dedicated section on the Ministry's website and a national platform for STEM activities, respectively. On the other hand, the participant from *Italy* said that there is currently no repository due to the country's fragmented landscape.

In general, most participants recognised the importance of these resources and agreed that their inclusion in policy recommendations and promotion plays an essential role.

Takeaway 3: Teacher training initiatives, networks and groups can make an important contribution to taking reforms forward and are crucial for making available the products, resources and tools of projects.

It was agreed that existing teacher training initiatives and networking communities are also fundamental to education reform, helping educators share and adopt new pedagogies, collaborate and self-improve. However, these are diverse due to the specificities of each education system; the participant from *Israel* stated that CPD takes place at national level through learning circles and courses and gave the example of both a *WhatsApp* group with around 2000 teachers, and a mailing list, the former being effective and the latter less useful.

The participant from *Italy* mentioned some national teacher training initiatives run by INDIRE and underlined that many other opportunities are organised by schools according to their needs. Moreover, the participant from *Malta* explained that training takes place in-house, with several groups of teachers from across the country being able to meet thanks to the small size of the nation, while the participant from *France* explained that more CPD opportunities for teachers, as well as the dissemination of results such as those from the co-organising projects through policy support, would help to facilitate reforms.

Both participants from *Portugal* stressed that the MoE is working with around 900 schools to integrate CPD into the curriculum. They also mentioned the use of a blog and club meetings as additional non-formal methods for educators to share their work. They also highlighted the prevalence of school clusters (defined as groups of geographically contiguous educational attendance areas) as the dominant structural model within the country; these clusters aim to channel education resources more effectively by making them available to groups of schools rather than individual schools.

The *Belgian (Flanders)* participant indicated that teachers can participate in a wide range of professional development initiatives organised by the umbrella organisations to which each school belongs. They also added that other organisations also offer professional development initiatives for teachers.

Takeaway 4: One important way of promoting the project and its products is by contextualising them within EU and International Political and Pedagogical ambitions (GreenComp, SDCs, etc).

In general, participants were enthusiastic about the lessons learnt from projects and how they could contribute to the further integration of green competences. This connection provides an opportunity to align projects with relevant European and international programmes and schemes.

Examples of such alignment were shared by some participants; those from *Cyprus* and *Spain* highlighted the fact that environmental and sustainability competences, in line with the European Union's GreenComp

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framework, are well integrated in all subjects due to the overall cross-curricular nature of their education systems.

Similarly, the participant from *Italy*, a country with a centralised system, pointed out that environmental competences are compulsory and integrated into the curricula, but noted that the situation is complex given the variety of green-related areas to be covered. The participant additionally emphasised the value of utilising GreenComp-aligned resources within the classroom, such as the Terra Mission MOOCs, as a means of aiding teachers.

The representatives from *Portugal* outlined the existence of a national key document that encapsulates the fundamental concepts, competencies and educational philosophy of the country. About *Belgium (Flanders)*, the participant indicated that a framework for education is in place and key competencies have been formulated with the modernisation of secondary education; these competences are used as a basis for the attainment goals, which in turn are based on international frameworks.

These examples show us that defining a meaningful context with the current relevant guidelines is decisive for the promotion of different projects and products.

More information

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