Deliverable 3.8 Teacher Education Report

BioBeo

Innovative Education for the BioEconomy

Co-funded by
the European Union

BioBeo

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1. Project factsheet

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4. Abbreviations

E3STEM	Hellenic Education Society of STEM
MU	Maynooth University
OUAS	ODISEE University of Applied Sciences
RUAS	Rotterdam University of Applied Sciences
SDG	Sustainable Development Goal
STEM	Science, Technology, Engineering and Mathematics
TUB	Technical University Berlin
UCD	University College Dublin
FEE	Foundation for Environmental Education
IPA	Stichting International Parents Alliance
UH	University of Hohenheim

5. Executive Summary

Welcome to the BioBeo Teacher Education Report:

The BioBeo Teacher Education Programme represents a core pillar of the BioBeo project's mission to embed sustainability, circularity, and bioeconomy principles within educational systems across Europe. Building on BioBeo's broader commitment to environmental literacy and societal transformation, this programme equips future educators with the knowledge, pedagogical tools, and international perspectives necessary to lead sustainability education in diverse contexts.

Since its launch, the Teacher Education Programme has achieved significant milestones across three key European institutions: Maynooth University (Ireland), Odisee University of Applied Sciences (Belgium), and Rotterdam University of Applied Sciences (The Netherlands), each demonstrating deep institutional commitment and innovative approaches to bioeconomy education:

Curricular Integration and Pedagogical Innovation:

At Maynooth University**,** the BioBeo programme was embedded within the final-year Professional Master of Education and Bachelor of Education through the EDF4141 Bioeconomy Education elective. Students engaged in reflective, values-based learning and contributed articles in Irish and English to the *BioBuzz* newsletter. 100% of student participants agreed that bioeconomy is important for the future, and 85% felt more hopeful for the planet.

At Odisee University, 47 student teachers incorporated BioBeo materials into their classroom practice as part of their biology didactics coursework. The university formally recognises participation in the *BioBeo Blended Intensive Programme (BIP)* on students' Diploma Supplements, integrating bioeconomy awareness into the structure of teacher preparation.

At Rotterdam University of Applied Sciences, BioBeo directly informed national curriculum updates under the *Curriculum.nu* initiative. Although "biobased economy" is not yet a stand-alone learning objective, its principles are deeply embedded in the revised biology, geography, economics, and citizenship syllabi. RUAS staff participated in reviewing draft curriculum documents, helping shape the future of sustainability education in the Netherlands.

Development of the Blended Intensive Programme (BIP):

One of the most impactful elements of the Teacher Education Programme has been the establishment of the *Blended Intensive Programme*, a 5 ECTS credit-bearing short mobility initiative supported by all three partner universities. Students from Ireland, Belgium, and the Netherlands gathered in Rotterdam (2025) for a week-long experience that included site visits to Blue City and Floating Farm, lectures on permaculture and biomimicry, artistic workshops, and a UN climate negotiation simulation. Before and after the mobility, students completed reflective assignments on their evolving understanding of bioeconomy in educational settings.

The BIP serves as both a pedagogical and social innovation, creating a pan-European learning environment that foregrounds intercultural learning, real-world application, and collaborative inquiry. Participants reported high levels of engagement, improved confidence, and a stronger sense of agency in their future roles as sustainability educators.

Strategic Vision and Long-Term Impact:

The BioBeo Teacher Education Programme embodies the project's broader commitment to interconnectedness and innovation. It not only enhances pre-service teacher education but actively contributes to shaping national and European curriculum agendas. Through evidence-based module design, international mobility, and cross-disciplinary learning, it cultivates the next generation of educators who will lead their communities towards a circular, inclusive, and sustainable future.

These collective efforts reflect the BioBeo project's capacity to build institutional and personal capacity at multiple levels, linking classroom practice with national reform and academic learning with cultural and emotional development. As BioBeo enters its legacy phase, the ongoing expansion of the BIP, further development of BioBuzz, and deeper curriculum integration across universities will ensure that its vision continues to flourish in teacher education and beyond.

Collaborative Framework

This programme is a collective endeavour involving esteemed institutions, including University College Dublin (Ireland) Maynooth University (Ireland), Rotterdam University of Applied Sciences (Netherlands), E3STEM (Greece), Technical University Berlin (Germany), and Odisee University of Applied Sciences (Belgium), University of Hohenheim (Germany) Stichting International Parents Alliance (IPA) and the Foundation for Environmental Education (FEE).

Future Directions:

With a strong focus on experiential learning and alignment with the Sustainable Development Goals (SDGs), the BioBeo Interconnectedness Programme is committed to ongoing evolution. It aims to nurture a generation of environmentally informed global citizens poised to drive the transition toward a sustainable and inclusive bioeconomy.

BioBeo Bioeconomy Definition:

"Bioeconomy is a systems-based approach that seeks to replace fossil resources in a sustainable manner with renewable biological resources from terrestrial and marine ecosystems – such as forests, crops, animals, fish, microorganisms, organic waste, and agricultural side streams, to produce food, feed, fibres, energy, bio-based products, and services within a circular economy framework designed to optimise resource use based on a cascading hierarchy of utilisation options. A sustainable and circular bioeconomy requires the application of

education and training programmes, scientific research, technology, and innovation with the aim of not only creating economic value but also regenerating and expanding ecosystems and biodiversity as well as improving the health and the well-being of society. By addressing these systemic changes in the economy, environment, and society, the bioeconomy contributes to achieving a better and more sustainable future where no one is left behind."

6. Introduction

The objective of Task 3.4 is to embed bioeconomy education within Initial Teacher Education (ITE) programmes across Europe through the BioBeo Teacher Education strand. This work seeks to equip student teachers with the knowledge, skills, and pedagogical confidence to teach sustainability and circularity principles in future classrooms, and to contribute to long-term cultural and curricular change. The initiative supports the European Green Deal and UNESCO's Education for Sustainable Development (ESD) goals by ensuring that future educators are fully prepared to lead the transition towards a circular, bio-based society.

Task 3.4 of the BioBeo project, led by Maynooth University (MU) with key contributions from Odisee University of Applied Sciences (OUAS) in Belgium and Rotterdam University of Applied Sciences (RUAS) in the Netherlands, focuses on developing and delivering teacher education models rooted in cross-curricular, values-based, and participatory learning. These models not only expose student teachers to theoretical frameworks underpinning the bioeconomy, but also give them hands-on, practice-based experiences through innovative elective modules, outdoor learning, interdisciplinary workshops, and international mobility programmes.

At the core of this task is the Blended Intensive Programme (BIP), a 5 ECTS short-term mobility initiative hosted by different partner institutions across 2024–2026. The BIP brings together teacher education students and educators from multiple European universities to engage in immersive, collaborative learning. Participants work across disciplines such as science, geography, economics, and citizenship, and take part in site visits, role-play activities, and reflection exercises that connect classroom learning to real-world sustainability challenges.

Each participating institution has embedded the BioBeo approach within their curriculum in unique ways. At MU, student teachers explore the intersection of language, music, and sustainability, contributing to bilingual outputs in English and Irish via the *BioBuzz* newsletter. At OUAS, BioBeo modules have been fully integrated into biology didactics courses, with active use of BioBeo resources during school placement. At RUAS, educators have played a formative role in shaping national curriculum reforms, ensuring bioeconomy principles are woven into subjects such as biology, geography, and economics at secondary level.

The following sections will present a detailed account of how BioBeo has been implemented in each university's teacher education programme. These examples highlight the success of BioBeo in building capacity, inspiring pedagogical innovation, and preparing future educators to play a transformative role in the sustainability transition across Europe.

Maynooth University (MU)

EDF4141: Bioeconomy Education Elective

Maynooth University (MU) has played a leading role in embedding the BioBeo project within its Initial Teacher Education (ITE) curriculum, significantly enriching student teachers' understanding of sustainability, the circular bioeconomy, and environmental education. Central to this integration is the elective module EDF4141: Bioeconomy Education, which awards 2.5 ECTS and is delivered to final-year students of the Professional Master of Education (PMEd2) and Bachelor of Education (B.Ed 4). This module was developed to promote reflective, critical engagement with the bioeconomy through a pedagogical lens. It supports national and European education goals for sustainable development.

Blended Intensive Programme (BIP)

Complementing this module, MU students have the opportunity to participate in the BioBeo Blended Intensive Programme (BIP), worth 5 ECTS. This programme brings together teacher education students and faculty from MU, Odisee (Belgium), and Rotterdam University of Applied Sciences (RUAS) for a short-term intensive international learning experience in 2024 and 2025.

Student Teachers and the Blended Intensive Programme (BIP) 2024

The Blended Intensive Programme (BIP) held at Maynooth University brought together over 50 third-level education students from BioBeo partner countries. A central learning activity was engaging directly with the BioBeo primary programme -including a lecture, hands-on activities, and group reflection on the theme of interconnectedness.

One student teacher described it as:
"One of the most significant learning experiences in my whole college training."

Summary of the BioBeo-BIP 2025

From March 7th to 14th, 2025, 33 teacher-students from Ireland, MU, Belgium, Odisee, and Rotterdam University of Applied Sciences (RUAS) and their teachers, gathered in Rotterdam for the BioBeo BIP program. Prior to the event, teacher training students completed an online assignment, sharing their vision of Bioeconomy in their lessons and schools. The program involved workshops, lectures, and site visits to Blue City, Delft, and the Hague, focusing on sustainability, bio-based economies, SDG's and climate change. At the end of the week, students were part of a UN role play on climate change. At home again, the students reflected online on how their vision had evolved. The diverse activities offered valuable insights into sustainable development practices across Europe.

Insights on the Development and Implementation of BIPs: A Reflection on Interconnectedness and Collaboration

The BioBeo project aims to create a sustainable future through bioeconomy education, and an important component is the Blended Intensive Programme (BIP). The BIP offers a powerful framework for establishing initial connections among educational institutions, fostering collaboration across Europe, and promoting the integration of sustainability and bioeconomy into education.

The Role of BIPs in Establishing Initial Connections Among Educational Institutions

The BIP plays a crucial role in initiating and strengthening the connections between educational institutions across Europe. These programmes bring together diverse schools, universities, and stakeholders from different countries, creating a platform for shared learning and collaboration. By engaging multiple institutions, BIPs provide opportunities for cross-cultural exchanges, where students not only learn about bioeconomy but also about different educational systems, teaching methods, and institutional practices.

For example, the BIP programme held in Rotterdam with participants from Ireland, Belgium, and the Netherlands facilitated networking between students and educational staff. Through joint workshops, lectures, field trips, and group assignments, these institutions built strong relationships that transcend geographical and institutional boundaries. This interconnectedness is foundational for creating long-term partnerships and future collaborations in the realm of sustainability and bioeconomy.

Additionally, the BIP promotes the integration of bioeconomy principles across different educational stages, from teacher training primary and secondary to higher education institutions. As these institutions come together through the BIP, they share common goals and challenges, which helps to align educational content, teaching methodologies, and research initiatives. The collaborative nature of BIPs establishes a network that encourages the exchange of best practices and innovative teaching strategies, benefiting both teachers and students alike.

The Impact of the BIP as an Innovative Tool for Collaboration Across Europe

The BIP serves as an innovative tool that extends beyond the classroom, playing a key role in fostering collaboration between academic institutions, local communities, businesses, and other stakeholders. This multifaceted collaboration is essential for addressing complex issues related to sustainability and bioeconomy. By involving different partners, including local businesses and environmental organisations, BIPs connect education with real-world applications, ensuring that students gain practical insights into bioeconomy practices.

One of the standout features of the BIP is its ability to bring together academic theory and hands-on experience. Activities like site visits to Blue City, the Floating Farm in Rotterdam or the exploration of sustainable cities like Delft offer students a chance to engage directly with sustainability in action. These visits not only broaden students' understanding of the bioeconomy but also help them see how these concepts can be applied in practice. They also help strengthen relationships with external partners who can offer insights and resources that enhance the educational experience.

The BIP also encourages cross-disciplinary learning. For instance, the workshops involving art-based methodologies and biomimicry show that bioeconomy education is not confined to one subject area. Students learn about the interconnectedness of different fields, such as biology, technology, economics, and design. This holistic approach nurtures innovative thinking, which is vital for addressing the challenges posed by the bioeconomy and environmental sustainability.

The involvement of external experts, such as Linda Buijsman’s lecture on food forest permaculture and Kees Klomp’s talk on bioeconomy, further enhances the value of the BIP. These interactions allow students to broaden their perspectives and understand how various professionals contribute to the bioeconomy.

Feedback and Observations on the Reception of the BIP

The reception of the BIP by the various stakeholders—primary and secondary school student teachers, and

practising teachers—has been overwhelmingly positive. For students, the BIP offers a unique opportunity to learn about bioeconomy in an engaging and interactive way. The practical approach helps them understand the relevance of bioeconomy to their lives and future careers.

For student teachers, the BIP is a transformative experience that enhances their pedagogical skills and deepens their understanding of how to teach sustainability concepts. The exposure to various teaching methods, such as art-based approaches or the use of biomimicry, provides future educators with valuable tools to incorporate bioeconomy into their curricula. Student teachers have appreciated the opportunity to collaborate with their peers from different countries, which has enriched their perspective on education and teaching practices.

Practising teachers, too, have benefited from the BIP. The programme provides them with a platform to update their knowledge on sustainability and bioeconomy while introducing them to new teaching methodologies that they can apply in their classrooms. Many teachers have expressed that the programme has sparked their own interest in sustainability, enabling them to incorporate more relevant topics into their teaching. Teachers also appreciate the opportunity to connect with colleagues from other countries, exchanging ideas on how to address the challenges of teaching bioeconomy at different educational levels.

Overall, the BIP has proven to be an effective and innovative way to engage both students and educators in the subject of bioeconomy. The positive feedback reflects the programme's success in creating a stimulating learning environment that fosters collaboration, exchange, and practical application.

Contributions to the Overarching Goal of Interconnectedness

At the heart of the BioBeo project lies the goal of fostering interconnectedness, bringing together different educational institutions, students, teachers and stakeholders to address global sustainability challenges. The BIP serves as a vital tool in achieving this goal. By encouraging cross-border collaboration, the BIP nurtures a European-wide network of educators, students, and sustainability professionals who can share knowledge, resources, and best practices.

The BIP contributes to the development of a European-wide community of practice focused on sustainability and bioeconomy education. As institutions and individuals from various countries engage with each other through the programme, they collectively work towards building a sustainable future. The BIP's focus on innovation, practical learning, and collaboration ensures that it aligns with the broader objectives of the BioBeo project, making it a key component in fostering an interconnected, sustainable European education network.

MU is also planning the next iteration of the Bioeconomy BIP in 2026/2027 in collaboration with the Arqus European University Alliance. This cross-university cooperation ensures further deepening of international engagement with bioeconomy education.

In conclusion, the development and implementation of BIPs have been instrumental in building initial connections among educational institutions, fostering innovation, and engaging actors in the bioeconomy field. Through its focus on collaboration, interdisciplinary learning, and real-world application, the BIP serves as a powerful tool in achieving the BioBeo project's overarching goal of interconnectedness and sustainability education. The positive reception of the programme by students, student teachers, and university teachers further highlights its success as an innovative and impactful educational initiative.

EDF627: Cumas na Gaeilge

One of the distinctive features of the assessment for EDF627 (2.5 credit module - Cumas na Gaeilge) is the production of student articles in English and Irish language focused on bioeconomy activities for the classroom for BioBuzz, a monthly bioeconomy newsletter that focuses on bioeconomy-related topics. BioBuzz is a monthly newsletter focused on environmental education and connecting teachers through the BEST Network. This contributes to a growing public awareness and educational engagement with the bioeconomy and supports students' development of academic writing, bilingual communication and dissemination skills.

Music Study

A study were conducted as part of Maynooth University's contribution to Bioeconomy Teacher Education. This study assessed the impact of music in bioeconomy education, involving 298 participants who engaged with An Talamh Bhláfar and the BioBeo song. Results showed that 82% felt their understanding of bioeconomy increased after listening to the songs and reading their lyrics, 80% were more motivated to live more sustainably after listening to the songs and reading their lyrics, and 68% found music effective in conveying scientific ideas.

Conclusion

Overall, MU's integration of BioBeo into teacher education reflects a systemic and interdisciplinary approach, combining formal curriculum, bilingual education, international collaboration, and arts-based dissemination. The programme not only enriches teacher training but also contributes to shaping future classrooms grounded in sustainability, creativity, and interconnected learning.

Rotterdam University of Applied Sciences, Netherlands (RUAS)

Integration of bioeconomy in the local curriculum:
For the BioBeo Secondary Education programme in Rotterdam, a new bio economy course was developed in teacher training economy. The students participated in that economy course, which is part of the obligatory curriculum at RUAS.
Part of the minor Sustainability and Big History was newly created with information of BioBeo, with lectures on Bio Economy, sustainability and circular economy.
These new initiatives Included a field trip to Blue City and to the Bio Economy hub in Rotterdam. Students of teacher training geography, biology and economics attend this minor and the courses within.

Teacher training students together with teacher training teachers developed lesson materials for BioBeo projects on secondary schools as part of a minor.
The materials developed were conducted annually in secondary schools, during the BioBio-project.

Curriculum Changes in the Netherlands:

Emphasizing Sustainability and the Biobased Economy

The Netherlands is undergoing significant updates to its secondary education national curriculum, with an increased focus on the biobased economy, climate change, and sustainability. These changes reflect the growing importance of addressing global environmental challenges and equipping students with the knowledge and skills to contribute to a

more sustainable future. The revisions cover a wide range of subjects, including geography, biology, economics, and citizenship, and are part of the broader *Curriculum.nu* project, which aims to make the national curriculum more relevant and aligned with current societal needs.

Biology Curriculum Changes

In biology, the updated curriculum places a strong emphasis on sustainability, biodiversity, and climate change. Students will explore the impact of climate change on ecosystems and biodiversity, as well as the role of sustainability measures in improving the health of the planet. There was some influence of the BioBeo Project, because the Dutch partner was asked to review the proposed changes in several stages of the process.
Key areas of focus include:

- **Sustainability & Climate Change**: Students will learn how climate change affects ecosystems and biodiversity, as well as the role of human activities in these processes.
- **Research & Methodology**: A greater emphasis is placed on developing students' research skills, with a focus on real-world applications such as the BioBeo project, which investigates sustainable practices in biology.
- **Biobased Economy**: Although the concept of the biobased economy is not explicitly mentioned in the biology curriculum, it is integrated into broader discussions on biodiversity, circularity, food production, and climate change. Students will learn about the importance of renewable resources, recycling, and sustainable production processes.

In addition to the environmental focus, the curriculum also includes traditional topics, such as the formation of landscapes, survival in different habitats, and the properties of substances and materials. Students will gain a deeper understanding of the complex relationships between living organisms, their environments, and the ways in which human actions impact the natural world.

Geography Curriculum Revisions

The geography curriculum is being revised to better address key environmental issues, with a particular focus on sustainability and climate change.
The revised curriculum includes the following key themes:

1. **Sustainable Development**: Students will explore how human activities impact the Earth, including the ecological footprint and ways to live more sustainably.
2. **Climate Change**: The curriculum delves into the causes and consequences of climate change, as well as the roles played by governments, businesses, and citizens in mitigating its effects.
3. **Energy and Environment**: Topics such as renewable energy, CO2 emissions, and the environmental impacts of industry and transport are also included.

These changes align with global initiatives, such as the United Nations' Sustainable Development Goals (SDGs), and reflect a commitment to providing students with the tools to understand and address the complex environmental issues facing the world today. Although the biobased economy is not a specific core objective yet, it is integrated within broader topics such as:

- **Renewable Energy and Raw Materials**: Introducing students to biomass and biobased products as alternatives to fossil fuels.
- **Circular Economy**: Focusing on the reuse of natural resources to promote sustainability.
- **Agriculture and Industry**: Examining how agriculture contributes to the production of biomass and the role of biobased solutions in various industries.

The Curriculum.nu project is guiding these updates, and some schools may offer specialized modules on the biobased economy in partnership with external organisations, such as colleges and companies. As sustainability continues to be a central focus, the biobased economy is expected to play an increasingly significant role in future curricula.

Economics Teacher Training

In addition to changes in the secondary education curriculum, the teacher training program for economics is also being updated. The revised curriculum includes new subdomains and indicators designed to deepen students' understanding of economic concepts and the challenges posed by modern society.

Key changes in the economics curriculum include:

1. **Discussing Limitations**: This subdomain encourages students to critically evaluate the limitations of traditional economic models, such as assumptions about rational behaviour, selfishness, and profit maximisation. Teachers are expected to discuss ethical dilemmas and the tension between normative and positive economics in real-world situations.
2. **Basic Principles of Economic Thought**: Teachers will provide students with a deeper understanding of core economic principles, such as cost/return reasoning, and the long-term consequences of economic decisions. For example, students will explore economic choices (e.g., going to the cinema) by considering both visible and hidden costs, as well as the broader impacts of those decisions.

Citizenship Curriculum Revisions

The curriculum for citizenship education is also undergoing updates, with a new core objective focused on social issues. This core objective aims to help students develop a critical understanding of the world around them and explore ways to address pressing social challenges. Key aspects of the revised curriculum include:

- **Core Objective: Social Issues**: Students will explore various social and planetary issues, such as sustainability, health, and technological advancements. They will learn to identify the interests and perspectives involved in current issues and reflect on how personal beliefs and values influence their actions.
- **Real-World Applications**: Students will engage in projects and discussions on topics like future-proof neighbourhoods, the impact of personal lifestyles on the planet, and societal inequalities. They will also use digital tools and mathematics to analyse global issues, such as income disparities and climate change.

This approach encourages students to consider both individual and collective contributions to solving social issues, fostering a sense of responsibility and empowerment in addressing the challenges of the 21st century.

Conclusion

The national curriculum updates in the Netherlands reflect a growing recognition of the need to equip students with the knowledge and skills to address the environmental and social challenges of the future. By integrating sustainability, climate change, and the biobased economy into various subjects, the revised curriculum aims to prepare students to be active, informed citizens who can contribute to building a sustainable, equitable world. As these changes are implemented, the biobased economy is expected to become an increasingly prominent theme in education, providing students with a solid foundation for addressing the complex issues facing society.

Biology Curriculum & Biobased Economy – Junior High Schools

There have been recent developments in education related to sustainability and climate change. In the Netherlands, the core objectives for secondary education are regularly revised.

Sustainability, biodiversity and climate change, are increasingly important themes in education, including in the subject of biology. The revision of the curriculum, in which sustainability is explicitly addressed, is high on the agenda. Within the proposed new core objectives, which are part of the broader Curriculum.nu project, more attention is paid to these themes. I was asked as subject expert, for biology by the SLO, the organization that is asked by the government to renew the curriculum for primary and Secondary Education.

Students will be asked to reasoning about how to solve an issue sustainably. They will be working on issues in the field of nature and in the area of climate change. They learn about the measures that have been taken over the past decennia that have been helpful in improving biodiversity in water and on land? In what way does climate change affect the change of ecosystems and how does this relate to change of biodiversity?

There is more focus on methodology and research. I have mentioned the BioBeo project and the need to focus on bioeconomy several times.
The concept of biobased economy is not literally addressed in the biology curriculum, it is included within broader themes of biodiversity, sustainability, food production and climate change.

Sources:

1. Curriculum.nu is afgerond
2. Home - SLO

Geography 2024 Curriculum & Biobased Economy – Junior High Schools

There have been recent developments in education related to sustainability and climate change. In the Netherlands, the core objectives for secondary education are regularly revised in order to respond to social changes.

Sustainability and climate change are increasingly important themes in education, including in the subject of **geography**. The revision of the curriculum, in which sustainability is explicitly addressed, is high on the agenda. Within the proposed new core objectives, which are part of the broader Curriculum.nu project, more attention is paid to themes such as:

1. Sustainable development: Students learn about the consequences of human actions on the earth, the ecological footprint and how we can live more sustainably.
2. Climate change: It examines the causes and consequences of climate change, and the role that different actors (such as governments, businesses and citizens) play in this.
3. Energy and environment: Topics such as the transition to renewable energy sources, CO2 emissions, and the impact of industry and transport on the environment are covered.

These themes are in line with broader international goals such as the Sustainable Development Goals (SDGs) of the United Nations, which also play an important role in education.

Within education, and especially in the context of sustainability, the **biobased economy** is receiving more and more attention. Although the concept itself often does not form a separate core objective, it is included within broader themes of sustainability and climate change.

Education and biobased economy: Although there is not (yet) a specific core goal that focuses only on the biobased economy, the theme is often discussed within the following topics:

1. **Renewable energy and raw materials**: Here, students learn about the use of biomass and biobased products as alternatives to fossil fuels.
2. **Circular economy**: In this context, the biobased economy is also discussed, because the reuse of natural raw materials is important in a circular system.
3. **Agriculture and industry**: The role of agriculture in the production of biomass, and the impact of biobased solutions on various industries, is often discussed

Within the Curriculum.nu project, which is leading the revision of the core objectives for secondary education, attention is paid to such current themes. Some schools may choose to offer modules or projects specifically aimed at the biobased economy in collaboration with external partners (such as colleges and companies). With the increasing focus on sustainability, it is expected that themes such as the biobased economy will be even more anchored in the future curriculum.

Sources:

1. Curriculum.nu is afgerond
2. Home - SLO

New in the curriculum of teacher training economics in the Netherlands (draft, will be implemented in 2026):

In addition the following two subdomains:

Subdomain 13.3: Discussing Limitations

Indicator 13.3.1

Discusses limitations of (common) economic models, theories or procedures and discusses alternative approaches in which attention is paid to behavioural economic insights such as limited rational or irrational behaviour, cooperation, altruism, reciprocity, possible tension between ethics and economics and tension between normative and positive practice of economics in relation to social issues.

The teacher who is qualified to start can;

- explain that the assumptions in economic models can also be about the view of man (whether or not limited rational, informed, selfish, whether or not risk aversion) as well as about the assumptions of the behavior of organizations (whether or not full focus on maximum profit) and governments (with or without limited rationality, perfect information and full focus on the common good)
- explain that in an economic dilemma such as 'Should the school promote the reading behaviour of pupils through financial incentives', there is both a positive ('will this instrument (also in the long term) lead to better reading pupils?) and a normative ('Wouldn't it be better to spend the money on a purpose other than promoting reading?') that there is an element in this.
- Explain that in the strategic interaction – analysed for example with the help of game theory – such as whether or not an employer invests in training his employee – between economic actors, it is important what (the perception of the other player is what) human images of both players are.

Subdomain 13.4: Basic Principles of Economic Thought

Indicator 13.4.1

Possesses theoretical knowledge of basic principles of economic thinking, such as people's reactions to stimuli, reasoning from cost/returns, sacrifice (costs) and alternative explanation of economic behavior from multiple perspectives in the real world.

The teacher who is qualified to start can;

- Explain that the economic decision whether or not to go to the cinema tonight is not only about the 'visible' costs of a visit to the cinema (=ticket, transport), but also the missed revenues (= lost (long-term) revenues of an evening of extra paid babysitting/studying/investing in relationships) of such a visit must be taken into account.
- explaining, for example on the basis of the 'parable of the broken window'1, that a good economist in situations is not only blinded by the immediately visible consequences for those present only and has an eye for (as yet) invisible long-term consequences for various stakeholders.

ODISEE University of Applied Sciences, Belgium (OUAS)

At Odisee University of Applied Sciences (OUAS), the BioBeo project has been successfully embedded into the teacher education curriculum for secondary education. A total of 47 student teachers were introduced to bioeconomy and the BioBeo programme through targeted coursework and practice-based assignments.

As part of the biology didactics courses in both the second and third years of the teacher education programme, students were assigned the task of engaging with and trialling BioBeo teaching materials

during their school practice placements. This initiative aimed to provide them with first-hand experience of incorporating bioeconomy education into classroom settings.

The integration of BioBeo into OUAS's formal curriculum reflects a meaningful institutional commitment to sustainability education. The programme is not only implemented within coursework but also formally recognised: participation in the BioBeo Blended Intensive Programme (BIP) is now recorded on the Diploma Supplement for students. This supplement provides an official summary of each student's academic achievements and recognises BIP participation as part of their formal teacher training.

Through this integration, OUAS ensures that future teachers are both theoretically and practically equipped to embed sustainability, circular economy principles, and bioeconomy awareness into secondary education. The inclusion of BioBeo on students' academic transcripts further underlines its value within teacher education and highlights Odisee's contribution to shaping future-oriented educators across Europe.

BEST Network (all partners)

1. Brief Summary of BEST

The BEST network is a community within the BioBeo project that connects bioeconomy and sustainability educators across Europe. Launched in March 2025 through the BioBuzz newsletter, it fosters communication, collaboration, and the sharing of best practices in bioeconomy education. Through the network, educators, including those involved in the BioBeo Blended Intensive Programme, share resources, engage in professional development, and promote the integration of bioeconomy and sustainability into educational settings. The network ensures long-term partnerships, supports continued learning, and disseminates key bioeconomy education information across Europe.

2. Insights on the Development and Implementation of BEST

The Role of BEST in Establishing Initial Connections Among Educational Institutions

The BEST network plays a central role in establishing initial connections among educational institutions across Europe. At the core of the BioBeo Interconnectedness Programme, BEST serves as a platform for the first point of contact, linking schools and universities that are part of the BioBeo consortium. By bringing together diverse educational institutions from Ireland, the Netherlands, Belgium, and beyond, BEST provides a space where educators can exchange ideas, resources, and teaching strategies. This interconnectedness is vital for the success of the "phenomenon-based" learning approach implemented within the BioBeo project, fostering a collaborative environment where both student teachers and practicing educators can learn from one another.

Through the BioBeo Education Programme, BEST has been able to facilitate direct communication between educators and schools, ensuring the exchange of knowledge on sustainable practices, bioeconomy concepts, and environmental awareness. These connections establish the foundation for ongoing partnerships, laying the groundwork for future collaborations that extend beyond the life of the BioBeo project. The network ensures that the sharing of best practices and resources is not confined to one institution or country, but rather connects a broader European community committed to sustainability education.

Impact of BEST as an Innovative Tool

BEST represents a highly innovative tool in the context of bioeconomy education. The network's strength lies in its ability to foster collaboration among educators and institutions through the Bioeconomy

Newsletter (BioBuzz). The newsletter serves as a key vehicle for disseminating educational materials, updates, and important initiatives related to bioeconomy and sustainability, making vital information accessible to a wide range of stakeholders, including primary and secondary school teachers, student teachers, and home educators. Currently we have 400 BEST members across Europe having subscribed through BioBuzz - this number is steadily growing each week. We envisage a community of 1000 members by December 2025.

The network's integration into the Blended Intensive Programme further enhances its impact. By having educators from diverse institutions serve on the BEST steering committee, the network is actively involved in the recruitment of new members and the growth of a community centred around shared learning goals. This inclusivity enables a greater exchange of ideas and resources, with members continuously contributing to discussions around bioeconomy education. BEST has also proved instrumental in addressing key challenges within sustainability education, providing educators with the tools to engage students in real-world experiences that are linked to environmental and economic sustainability.

The role of BEST in fostering cross-border collaboration and its influence on the BioBeo European Festival also cannot be overstated. By connecting educators from multiple countries, the network helps ensure that students are exposed to global perspectives on bioeconomy, creating an atmosphere where international dialogue thrives. This interconnectedness further reinforces the BioBeo project's goal of increasing awareness and knowledge of the bioeconomy across Europe.

Feedback on How BEST Has Been Received by Educators and Students

The reception of BEST has been overwhelmingly positive among educators, student teachers, and practising teachers. The initial connections made through the BEST network have been invaluable for educators, providing them with access to a diverse range of educational resources, research, and real-world case studies. The opportunity to connect with peers from different countries and share teaching practices has not only enhanced their professional development but also empowered them to implement more effective bioeconomy curricula within their classrooms. Survey results indicate that 87.5% of participants felt better equipped with practical teaching strategies, particularly in integrating outdoor learning and real-world bioeconomy concepts into their teaching. Additionally, 100% of participants reported a stronger commitment to sustainability and environmental stewardship, with 81.3% planning to integrate insights learned during BEST activities into their educational practice. The interactive and hands-on approach, including workshops and outdoor activities, was key in making bioeconomy concepts more accessible and actionable for educators.

The BioBeo Blended Intensive Programme, which allows educators to participate in international learning experiences, has been particularly well-received. Teachers who participated in the programme report a greater understanding of how to integrate bioeconomy principles into their teaching, both in terms of content and teaching methods. Additionally, feedback from primary and secondary school students has indicated a strong engagement with the bioeconomy topics covered in the programme, as well as a sense of connection with their peers in other European countries. Students appreciated the interactive learning environment, which emphasised hands-on learning and real-world applications, helping them see the direct impact of the bioeconomy on their communities.

The BioBeo Blended Intensive Programme (BIP) has effectively enhanced educators' understanding and confidence in teaching bioeconomy principles. Survey results indicate a substantial increase in comprehension levels, with the proportion of participants reporting an excellent understanding rising from 12.5% pre-programme to 68.8% post-programme. Additionally, 87.5% of respondents felt well-prepared to

implement bioeconomy concepts in their teaching, particularly through outdoor learning and real-world applications. Confidence in explaining bioeconomy concepts also improved, with 81.3% of participants expressing confidence post-programme. In-person sessions were efficient, with 68.8% of participants rating their comprehension and engagement as excellent. Furthermore, 100% of respondents reported that the programme influenced their perspectives on sustainability, leading to more significant efforts to integrate sustainable practices into their personal and professional lives. These statistics underscore the programme's success in fostering knowledge and engagement with bioeconomy topics.

BEST's Contribution to the Overarching Goal of Interconnectedness

The principle of interconnectedness is foundational to the BioBeo project, and BEST plays a pivotal role in bringing this principle to life. By creating a shared space for educators to connect, collaborate, and share resources, BEST embodies the core value of interconnectedness that the BioBeo project seeks to promote. Educators involved in the network not only share knowledge about bioeconomy but also work together to develop innovative educational strategies that promote sustainability education across Europe.

Through its annual BEST meetings and continued engagement via the BioBuzz newsletter, the network ensures that the exchange of ideas remains a continuous process, allowing members to reflect on their practices and make improvements based on new developments in the field of bioeconomy. This ongoing exchange of knowledge has strengthened the collaborative efforts of the BioBeo consortium and increased the visibility of bioeconomy education, positioning it as a key component of the sustainability agenda across European educational systems.

In addition, the inclusive nature of BEST, which encourages participation from a broad range of educators and institutions, strengthens the sense of global interconnectedness. The opportunity for institutions to join the network through simple subscription to the Bioeconomy Newsletter has enabled a growing community of educators who are passionate about teaching sustainability and bioeconomy, thereby expanding the reach of the BioBeo project far beyond the initial partner institutions. This continued engagement ensures that the principles of interconnectedness will persist long after the BioBeo project concludes, creating a lasting impact on sustainability education.

The BEST network has proven to be an indispensable tool in fostering collaboration, disseminating important bioeconomy education materials, and promoting interconnectedness among educational institutions across Europe. Through the continued development and implementation of the BEST network, the BioBeo project has successfully built a vibrant, sustainable community of educators committed to advancing sustainability education. As the network grows, it will continue to play a key role in shaping the future of bioeconomy education and ensuring that sustainability concepts are integrated into classrooms across Europe for years to come.

7. Conclusion

The BioBeo Teacher Education Programme stands as a pioneering initiative in the advancement of sustainability and bioeconomy education within European Initial Teacher Education (ITE). By embedding bioeconomy principles into the curricula of Maynooth University, Odisee University of Applied Sciences, and Rotterdam University of Applied Sciences, the Programme has delivered transformative experiences that empower future educators to lead the transition toward a more sustainable, circular society.

Through innovative teaching modules, interdisciplinary methods, and immersive experiences such as the Blended Intensive Programme (BIP), BioBeo has bridged the gap between theory and practice in teacher education. The programme's strategic use of outdoor learning, arts-based methodologies, cross-border collaboration, and bilingual engagement has not only enhanced environmental literacy among student teachers but also deepened their professional capacity to teach bioeconomy in a meaningful and culturally resonant way.

At Maynooth University, students explored bioeconomy through academic writing, Irish-language media, and a large-scale study on music as a pedagogical tool. Odisee integrated BioBeo resources into biology didactics and school placement experiences, while recognising BIP engagement on formal academic records. In the Netherlands, Rotterdam University of Applied Sciences contributed to shaping national curriculum reforms in subjects such as biology, geography, and economics, incorporating core themes of sustainability and circular thinking that reflect BioBeo's influence.

Central to the programme's impact is the Blended Intensive Programme, a model of experiential, collaborative, and interdisciplinary teacher education. The BIP brought together 33 student teachers from three countries for a week-long learning journey in Rotterdam, centred on sustainability, systems thinking, and cultural exchange. These experiences illustrate how the BioBeo project is not only preparing student teachers to understand complex environmental challenges but equipping them with tools to teach creatively and confidently in their own classrooms.

Looking ahead, the Teacher Education Programme will continue to evolve through expanded BIP offerings, deepened curriculum integration, and dissemination through platforms such as *BioBuzz*. The upcoming BEST Conference in 2026 and its resulting peer-reviewed publication will further strengthen BioBeo's legacy in the field of teacher education.

In sum, the BioBeo Teacher Education Programme exemplifies a collaborative, cross-European response to the educational demands of the sustainability transition. It affirms the vital role of teachers as changemakers and knowledge multipliers, and it lays the groundwork for a resilient, interconnected network of educators who will champion bioeconomy and environmental education for generations to come.