D2.2: Blueprint and Methodology for Innovative Governance

BioBeo

Innovative Education for the BioEconomy

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Abbreviations

CDS	Curriculum by School Decision
CSOs	Civil Society Organisations
CSPE	Civic, Social and Political Education
CSR	Corporate Social Responsibility
DUK	Deutsche UNESCO-Kommission
EC	European Commission
ESD	Education about Sustainable Development
EU	European Union
GCE	Global Citizenship Education
LRAs	Local and/or Regional Authorities
NCCA	The National Council for Curriculum and Assessment
NGOs	Non-governmental Organisations
PE	Physical Education
SPHE	Social, Personal and Health Education
STEM	Science, Technology, Engineering and Mathematics
UNESCO	United Nations Educational, Scientific and Cultural Organization
VET	Vocational Education and Training

Executive Summary

In this report, we consider what the institutional and social environment related to the introduction of new content (especially bioeconomy) into schools is in different countries, and which models and conditions can be identified as the most favourable. The preparation of the report began with a template that was designed to help each project partner provide the information necessary for the foreseen analyses. The partners then conducted the data collection process, using the expert knowledge available to each organisation as well as available statistics, systematic literature review (scientific literature + grey literature), legal analysis (national laws on education) and curriculum analysis (when applicable). Those were supplemented by primary data obtained through semi-structured interviews (with teachers, school heads, school boards, and local or regional authorities [LRAs], etc.), based on scripts provided by CASE. Finally, the data were analysed by the CASE team using thematic analysis, a method of qualitative data analysis that involves screening a dataset to identify, analyse and present recurring patterns.

Key findings

- In the school environment, and among groups capable of influencing the introduction of new content into schools, there are many actors with varying levels of involvement, internal diversity, and different rights and obligations. Participation in education subsequently translates into civic engagement outside of school.
- Procedures allowing for the introduction of new content into schools can be initiated by teachers, schools (including school boards) and their school heads, as well as leading authorities and the government.
- Although is it possible to identify legal, organisational, and socio-cultural barriers hindering the introduction of new content into schools, in essence they all have a multidimensional character and constitute a complex network of obstacles and opportunities.

Key recommendations

- When introducing new content into schools, it is important to involve the widest possible range of actors, including students, parents, and teachers.
- It is important to ensure a variety of procedures enabling the introduction of new content into schools within the education system, so that they are tailored to different needs depending on the nature of the desired changes.
- Ensuring good, innovative governance in education allows for better adjustment of the content taught in schools.

The contents of the report and the approach to achieving the above points are presented in further detail in the subsequent sections of the executive summary.

Many countries have the same set of actors involved in curriculum development, yet in each case their engagement varies depending on cultural, social, legislative, and other contextual forces.

Actors	Sub-actors	Responsibilities
Politicians and policy-makers	Federal governments/state governments	Setting national curriculum frameworks
	Parliaments	Establishing institutions

	Local governments Education authorities	Providing infrastructure
Schools	Teachers Headmasters Non-teaching staff Inspectorates and supervisors	Implementing and adapting national curricula Day-to-day school management Some degree of curriculum-making Quality assurance
Parents	In-class government In-school parent councils Inter-school parent associations National/municipal parents' representatives	Deciding on internal class matters Representing parents' voices in school decision-making Constitutive powers on some educational or preventative programmes Assistance in developing policies Promoting parents' initiatives
Students	In-class government In-school interest groups or cooperatives Inter-school partnerships National/municipal student representatives	Decisions and responsibilities on a class or school level Organising around particular topics Advocacy for children's rights Advising on policies and decisions
School networks	Inter-school networks and associations	Formal partnerships in an administrative sense Voluntary organising around similar values or focus
Non-formal educators	After-school care Non-Governmental Organisations (NGOs) Adult education providers Cultural and educational institutions (museums, libraries, zoos)	Facilitating extracurriculars Developing civic engagement and skills Adult education and skill acquisition
Business	School apprenticeships Donations and Corporate Social Responsibility (CSR) Entrepreneurship	Providing student apprenticeships Sourcing potential workers Material donations and volunteering Support for young entrepreneurs and innovative education solutions
Religious bodies	Religious patrons Leading authorities	Deciding about the curriculum as patrons Implementing religious values in the curriculum/teaching methods
Collaborative bodies	Internal school joint committees School network collaborations Collaborations on a national level	Representing all school stakeholders in shared decision-making Can be an association under similar school programmes

		Advisory role to the Ministries

Table 1. Actors in curriculum decision-making. Source: own elaboration.

There are diverse procedures pertaining to the integration of novel educational content in school curricula across different countries. Some of them are presented in the table below.

Procedures for introducing new content into schools – overview			
Type of procedure	**Examples**	**Strengths**	**Weaknesses**
Procedures in the hands of teachers	Through hours not covered by the standard curriculum Through the framework of existing subjects	high flexibility low bureaucracy	no (additional) funding provided no (additional) training or professional support provided small scale short term
Procedures in the hands of schools and/or their school heads	Through hours designated for school heads Through school-based curricula Through short courses Through pedagogical innovations	high flexibility a framework for action to ensure quality (sometimes) financial and support provided	small scale (usually) short term
Procedures in the hands of leading authorities and/or government	Through pedagogical experiments Through curriculum change Through cross-curricular topics Through small-scale educational programmes in cooperation with LRAs and leading authorities	large scale supervision system to ensure quality long term	low flexibility significant politicisation high bureaucracy

Table 2. Procedures for introducing new content into schools – overview. Source: own elaboration.

Given the diverse educational backgrounds and institutional frameworks across countries, there are numerous challenges and barriers when it comes to introducing new educational content. However, three main categories of barriers – legal, organisational, and socio-cultural – can be highlighted. A more detailed classification of the barriers is presented below.

Barriers related to introducing new content into teaching		
Legal barriers	**Organisational barriers**	**Socio-cultural barriers**
Restriction connected to national curriculum frameworks Compulsory subjects' constraints Centralised decision-making processes Bureaucracy Limited autonomy of schools Assessment and examination standardisation	Time-related barriers Infrastructure challenges Barriers related to educational materials Challenges in teacher capacities Financial constraints	Limited awareness and lack of acknowledgement Climate anxiety Cultural norms and values

Teachers' qualification and training challenges		
Resource allocation and funding limitations		
Resistance to change and educational traditions		

Table 3. Barriers related to introducing new content into teaching. Source: own elaboration.

Civic society and participation play a key role in introducing new content such as bioeconomy to curricula. Implementing participatory and civic orientation requires rethinking positivist education and shifting to more inclusive and collaborative teaching and learning. The approach of community-based learning shows great prospects in nurturing civic responsibility, which can help in connecting with local communities, important stakeholders and personal needs. The most important part of civic participation in sustainability and environmental education is youth-led activism, in which young people act and voice their needs for the purpose of leading social change. Finally, social innovation fosters democratic skills and citizen empowerment, which leads to more sustainable and circular practices.

Citizens' engagement in curriculum-making can be dependent on the participation and community models – whether public engagement is encouraged, how actors orient themselves towards one another, and what the degree of general public engagement is. Factors that contribute to participation in governance structures include inclusivity and collaborative efforts, favourable political contexts, dialogue between civil society organisations (CSOs) and other organisations, and models that adapt grassroots actions into wider agenda. All these factors can help or hinder participation, and the degree of this participation affects curriculum-making and implementation in various ways.

In our recommendations, we begin with a proposal of a model approach to social participation in education that involves the cooperation of actors on three levels: policy, school, and social environment. We discuss the benefits of this cooperation, such as enriching the educational landscape, fostering social inclusion and civic engagement, enhancing the sense of responsibility and ownership, and promoting diversity and inclusion. At the same time we address the challenges of this cooperation, such as ensuring the quality and sustainability of the participation framework, respecting the autonomy and voice of each actor, and avoiding the negative impacts of politicisation, monetisation and indoctrination. We argue that this approach can improve the quality and sustainability of the education system, and enable the introduction of new content to schools, by involving the expertise, perspectives and needs of various stakeholders, and by ensuring their involvement and acceptance.

In the next section we return to the procedures for introducing new content into schools and their assessment. We distinguish certain features that should be considered in designing the procedures, such as:

- funding (schools should have more autonomy and receive adequate resources to support the introduction of new content)
- teachers' working conditions (decent wages, reasonable workload, and availability of professional support and the support of other actors in the school community)
- forms (procedures should allow for flexibility and diversity in the forms of delivering new content)
- depoliticisation (reduction of political interference)

- inclusion (various actors should participate in the decision making and implementation of the new content)

The need for an evaluation and development process that includes all the above elements is highlighted.

At the end, we refer to the elements of the BioBeo curriculum created within the project, and place them in the context of the considerations contained in this report.

Table of Contents

1. Introduction – aims, context and methodology

Aims

This report is a Blueprint and Methodology for Innovative Governance, a deliverable prepared in the framework of Task 2.5 of the project BioBeo – Innovative Education for Bioeconomy. It is primarily addressed to the academic community, experts and policymakers interested in educational policies and the introduction of new content into schools.

BioBeo introduces new thinking and approaches in education on the circular economy across Europe. The project has developed – and will continue to develop – many excellent materials that can be used to educate about the bioeconomy. At the same time, however, in many education systems bioeconomy is not yet a topic that has found its way fully into the curriculum – it has yet to be introduced into schools. Across countries, there are diverse institutional and social environments that enable the introduction of new content into schools in various ways. Hence the importance of analysing how to strategically overcome the institutional and cultural barriers to implementing relevant circular bioeconomy education programmes in preschool, primary, and secondary schools.

In this report we therefore consider what the institutional and social environment related to the introduction of new content (especially bioeconomy) into schools is in different countries, and which models and conditions can be identified as the most favourable.

Context

The dynamic changes taking place in the world and society mean that school curricula often fail to keep up and may appear somewhat outdated or inadequate for the challenges of the present day. Some countries are doing a better job of updating their curricula than others. Undoubtedly, however, the problem of how to introduce new content into schools and how to make curricula more innovative is a shared one.

Depending on what type of content it is, the challenges of introducing it may differ slightly. Teaching programming requires different resources than teaching interpersonal skills (although it would be wrong to say that they cannot be taught at the same time). Our focus in BioBeo is directed towards bioeconomy, hence this will be our main point of reference in describing the procedures, barriers, and relevant actors. Nevertheless, in many cases these will be issues that affect anyone trying to teach something new, not anticipated to date in the curriculum.

For the sake of clarity of further considerations, it is necessary at this point to briefly indicate what the bioeconomy, the education of which we advocate, is. The following definition was developed for BioBeo by the University of Hohenheim team (Reinmuth, Gökçen Zwack 2023):

> *Bioeconomy is a system-based approach in which fossil resources are to be replaced in a sustainable manner by 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 programs, scientific research, technology, and innovation with the aim of not only creating economic value but also regeneration and extension of ecosystems and biodiversity as well as improvement of health and well-being of the society. By addressing these systemic changes in the economy, the environment, and the society, the bioeconomy contributes to achieving a better and more sustainable future in which no one is left behind.

Introducing education for bioeconomy into schools will not be possible – or at least not sufficiently effective – without societal involvement in the process. Hence, in this report we present a catalogue of actors who can be initiators, catalysts or facilitators in the introduction of new content into schools. This report is also complemented by the Digital Handbook, part of the BioBeo website: www.biobeo.eu. There, by following the flowchart, anyone wishing to implement education for bioeconomy or any other innovation at school can find out how to do so.

Methodology

This report was prepared as part of Work Package 2: Innovative Governance. The main objective of this work package was to bring new thinking and approaches to the forward-looking management of education in the circular bioeconomy, and ensure its innovation when implemented by education systems across Europe at the European Commission (EC), national, regional, and local levels. The preparation of the report proceeded in the following steps:

Firstly, a template was designed to help each project partner provide the information necessary for the foreseen analyses. Each project partner was asked to fill out the template carefully and thoroughly. The Template consisted of 5 parts:

- Part I, which described contextual information about the different education systems
- Part II, in which the main actors and their legal and social capacities to influence the design of the curriculum and what is taught in school were indicated
- Part III, on barriers to introducing new content into schools – legal, organisational and socio-cultural
- Part IV, where new content successfully implemented could be identified as part of opportunities & lessons learned
- Part V, allowing free expression of thoughts and indication of recommendations

Secondly, the partners conducted a data collection process. They used expert knowledge available to each organisation and:

- As main data sources – secondary data:
  - o available statistics
  - o systematic literature review (academic literature + grey literature)

- - o legal analysis (national laws on education)
    - o curriculum analysis (when applicable)
  - As supplementary data sources – primary data:
    - o semi-structured interviews (with teachers, school heads, school boards, LRAs, etc.) – based on scripts provided by CASE

The number of interviews depended on each partner's data collection needs, and ranged from 3 to 7.

Thirdly, the analysis was conducted by the CASE team using thematic analysis (see Merton 1975; Aronson 1995; Boyatzis 1998; Attride-Stirling 2001; Braun & Clarke 2006; Joffe 2011), a method of qualitative data analysis that involves screening a dataset to identify, analyse and present recurring patterns (Braun and Clarke 2006).

The structure of the report is based on the templates used for data collection. We start with an analysis of the environment, that is, the most relevant actors, before moving on to the procedures for introducing new content into schools and then the barriers that may hinder this. We then describe societal involvement in setting bioeconomy policy, and engagement focusing on curricula innovations. We conclude with recommendations with which we contribute to the creation of a common innovative governance structure to support the introduction of new content into schools.

2. Curriculum decision-making: the actors

The introduction of new curricula in schools is a complex process that demands well-considered decision-making. Multiple stakeholders are involved in both the drafting and implementation stages of a curriculum. Despite having similar sets of decision-makers reoccurring across different countries, their level of involvement can vary depending on factors such as established procedures, institutions, and school levels. This section will describe the essential actors responsible for establishing a new curriculum, their respective roles and responsibilities, and some practical examples of their involvement from different countries.

Politicians and policy makers

In most countries, the federal government plays a crucial role in the different stages of drafting a new curriculum. The degree and stage of involvement are determined by educational policies, associated governmental actors, and school types. The federal government often shares responsibilities with local governments, be they at the municipal or state level. The government also consults with other stakeholders, such as advisory bodies or experts.

The process of modifying or updating a curriculum is often started by the government, which conducts its own research or receives recommendations from educational experts. The initiated process in different countries has different pathways, but one of the common ones is to later proceed with consulting experts, such as educational researchers, advisory boards and organisations. For example, in Austria the Federal Ministry for Education, Science and Research makes the decision to change or add a new curriculum, but the drafts are compiled by local and international experts and stakeholders' representatives. After multiple revisions, including one from the governmental curriculum creation committee, the parliament decides whether the curriculum can be implemented.

A unified national curriculum that is tailored to the age or level of education is created by federal governments in countries like Belgium, Estonia, the Netherlands and Poland, among others, ensuring consistency across institutions. The level of governmental participation can vary, ranging from establishing objectives to proposing implementation strategies and even determining specific programme elements. In the first scenario, the governments can set up general educational objectives. For example, in Belgium a team of experts from the Flemish Ministry of Education and Training creates educational and development goals that the Ministry believes all students should achieve. The nationally set goals include a minimum of expected knowledge, understanding, skills and attitudes. Further, it is up to the teaching institutions how to implement these. In another scenario, the government is more precise in setting out implementation guidelines, but leaves the execution to the educational institutions. This is the case in Estonia, where the Education and Youth Authority, established by the Ministry of Education and Research, supports education policy implementation and provides optional resources and advisory services to assist individual schools. The final scenario is when the governments can be very precise with establishing a core curriculum for each level of education. In Poland, the details are discussed on a granular level, where the government sets out a compulsory reading list or specific topics to be covered in each subject on every level. This, however, is prone to ideological influence when some politically correct discourses are conveyed at the educational level, which was the case during the rule of the Law and Justice right-wing government in Poland.

The federal government can share responsibilities for curricula on different educational levels and for different types of institution. Some governments have an influence across all stages of education, starting as early as preschool. This was the case in Poland, where in 2021 the Ministry of National Education and the Ministry of Higher Education and Science were merged into the single Ministry of Education and Science, which decided about educational matters from pre-school to higher education. This merge will be reversed in 2023. In Hungary, the responsibilities are aligned with different types of schooling and training. The main body responsible for general education is the Ministry of the Interior, under which is the State Secretariat Responsible for General Education. But for vocational and adult training and for higher education, the decisive factor is the State Secretary Responsible for Innovation and Higher Education under the Ministry for Culture and Innovation. For higher education, there is a Deputy State Secretary of Higher Education. For vocational training, the Deputy State Secretary of Vocational Training, the Ministry of Agriculture, and the Ministry of Defence also take part in educational tasks. The final important actor in education policy is the Educational Authority, which is subordinate to the Ministry of the Interior.

The federal government can have different bodies to execute curriculum implementation. For example, in the Netherlands, various federal institutions have distinct responsibilities. The Ministry of Education, Culture, and Science has the legal authority to set the overarching educational framework and determine the core subjects that must be included in the national exams. The governmental agency Education Inspectorate has the legal mandate to monitor compliance with educational standards and regulations, including adherence to the prescribed curriculum. Curriculum Development and Examination Boards operate within the legal framework to develop subject-specific curricula and examinations that align with national guidelines. The Dutch Parliament is the legislative body that passes education laws and approves the national education budget.

It is also important to note that even if there is no national curriculum, policy can impact curricula through financial incentives, training and teaching support.

State-run educational institutions can also serve as a platform for implementing innovative teaching methodologies and exploring novel syllabi. Public schools in Austria may serve as a platform for school experiments or model experiments, where the Federal Minister tests out new educational schemes and organisational solutions before implementing them into the national curriculum. Similarly, in Ireland, non-denominational national schools owned by the state are designated as 'model schools' and used for teacher training.

The federal government's responsibilities are often shared with local governments, with the exact level and scope of involvement varying depending on the situation. In Austria, while the federal government is uniformly responsible for general education and vocational education and training (VET) schools and colleges, the distribution of competencies for compulsory schools (primary schools, lower secondary schools or compulsory middle schools, special schools, polytechnic schools and vocational schools) is more complicated. The federal government is responsible for framework legislation, and provinces are responsible for implementing legislation.

In Germany, the individual federal states are responsible for education policy and the respective school system in the federal state. Children do not always have the same curriculum in every state, and textbooks may differ as well. Individual states also have different types of schools. The cooperation is between the state governments and local governments. The state oversees internal school affairs, while external school matters are the responsibility of school-maintaining bodies, such as towns, cities, municipalities or rural districts. These bodies are responsible for school infrastructure, including buildings and furnishings, as well as the procurement and provision of learning materials, administrative staff, ongoing administration, non-personnel costs and non-teaching staff. Additionally, they are typically responsible for school organisation measures, such as establishing, modifying and closing schools.

The responsibility for setting educational policies in countries typically rests with the government, although the local level is often tasked with implementing them. The extent of government involvement varies across the different nations, with some placing more authority in individual schools.

Schools

Educational institutions are key players in introducing new curricula. The degrees of involvement differ from one country to another, with some only involved at the implementation stage through having some degree of power to incorporate new content, while some schools determine their own curricula. Conversely, different actors within schools are involved in introducing new content into classrooms in various ways. The school landscape involves several important stakeholders, such as teachers, headmasters, administrative staff, non-teaching staff, and teachers' associations and unions.

As mentioned in the previous section, in some countries the government can initiate the process for a new curriculum and decide on the expected outcomes of learning, but the schools are responsible for creating the actual curriculum that will put the governmental targets into practice. This is the case for many countries included in this study: Belgium (Flanders), Estonia, Ireland, Hungary and Wales. In Estonia, for example, schools adhere to the national curriculum as they develop their own school-based curricula. The national curriculum also determines who should be involved in the creation of the school curriculum, for example a school board, student council or teachers' council. The Ministry of Education and Research has an Education and Youth

Authority that supports education policy implementation by providing resources and advisory services to individual schools. In Austria, schools not only decide on the autonomous curriculum but also on how education is run: the structuring of classes, class and group size, number of school weekdays, and free days. A school-autonomous curriculum can also require additional staff or resources that are not planned in the national curriculum, which requires a competent school authority's approval. In Ireland, school patrons are free to choose their curriculum, but it needs to be approved by the Ministry. There are also alternative curricula that are already developed, and the school may choose these and not have to develop their own.

In some countries, much responsibility for curriculum development, implementation and adaptation lies in the hands of individual teachers. Teachers in the Netherlands have a significant say in the implementation and adaptation of the curriculum in their classrooms – a local curriculum is developed by the teaching team led by the school head. They play a crucial role in delivering the curriculum content, and may have input in its development through consultations and feedback processes. Teachers hold significant expertise and knowledge about effective teaching practices and subject content, allowing them to provide valuable input during curriculum development and implementation. In Poland, although the curriculum is firmly set by the national government, teachers in each school are grouped in a Board of Teachers, which makes decisions about internal school matters, monitors students' progress and graduation, decides about the introduction of innovative and experimental programmes in school, and handles teachers' matters. The headmaster's proposals are also subject to opinions from the Board of Teachers. In Belgium (Flanders), teachers also form informal in-school teacher teams or groups that work together within the same school subject or grade level. They meet regularly to plan lessons, share resources and discuss student progress.

Some schools assign higher authority to the headmasters, who make decisions about the school curriculum and management. For example, in Germany the school head teacher (*Rektor* in German) is responsible for educational and counselling work in the school, and is also a member of the teaching staff. The head teacher, while being subject to the legal and administrative regulations of the school supervisory authority, is also authorised to issue instructions regarding staff supervision and academic supervision. In Austria, the headmaster also determines the focus area for the school, for example: linguistic, humanistic and humanities area of focus; natural science and mathematics area of focus; economic and life science (including practical) area of focus; or artistic-creative areas of focus.

Other non-teaching staff are employed in the school, often with a limited degree of say in the school's conduct. For example, in Hungary, depending on the size of the school, school psychologists, speech therapists, social workers, teaching assistants, school librarians and school police officers may be employed. There are also administrative staff, cleaning and kitchen staff and janitors. However, there is no representation of non-teaching staff on the school board, and in most schools they don't take part in decision-making; their opinion is not taken into consideration for the educational programme.

Many countries also involve governmental or independent inspectors or supervisors who are responsible for overseeing and assessing educational institutions. In Poland, there are local superintendencies that supervise public and non-public kindergartens, special kindergartens, primary schools, secondary schools, special education institutions, and psychological and pedagogical counselling centres. Their responsibilities include: assessing the quality of and evaluating teaching and caring activities of schools, institutions and teachers; providing assistance to the educational institutions; and inspiring teachers to develop educational, methodological and organisational innovations. In the Netherlands, the Inspectorate of Education is an

independent organisation responsible for monitoring the quality of education in the country. School inspectors conduct inspections and evaluations to ensure schools comply with education standards and regulations.

There are a number of organisations that represent teachers' and school workers' interests. These include teachers' unions, chambers, and professional organisations. In most of the countries studied trade unions play a crucial role in advocating for education professionals. They negotiate working conditions, advocate for fair wages, and promote professional development opportunities. In many countries, such as the Netherlands, optional professional associations bring together teachers with shared interests or specialties. These associations focus on specific subjects, educational methodologies, or areas of expertise. They often organise conferences, workshops and training sessions to enhance teachers' skills and knowledge. In Austria, the Chamber of Labour has a department dedicated to education, and takes an active part in political debates to represent the interests of teachers and workers in general.

Although in many cases schools have significant independence in preparing and delivering the curriculum, parents' representatives are often consulted.

Parents

Although they are not directly responsible for designing the curriculum, student and parents' associations have the ability to promote alterations in the curriculum to address particular needs or issues. Through consultations, they can offer feedback and provide valuable insights into how the curriculum affects the students' educational experience. Parents can participate in decision-making processes and organise themselves within their classes and schools, and at inter-school, municipal, regional and national levels.

Parents can form close partnerships within a single class to make decisions more directly impacting their own children and their closest peers. For example, in Poland there is a body called the 'class three', whereby three parents are selected to make decisions about internal class matters, for example field trips or class funds, or to resolve internal disputes. The 'class three' usually consist of a leader, a deputy, and a treasurer. The 'class three' also represent the interests of a particular grade within school or educational institution as a whole. However, this formation is not regulated by any law, and no specific decision-making power has been established for it.

Most countries examined in the study have in-school parent committees or councils. In Hungary, parents have the right to form parent councils, and according to the Education Act, they have the right to voice their opinions regarding various matters of school governance. Usually, all classes choose two parents as class representatives for the Parents' Committee of the school. Hungarian parents also have a proportionate representation in each school board that decides on the school's main documents, including the teaching programme. In Poland, parent councils are also mandatory and have the power to apply to all key entities managing the school, such as the school head, the teaching council, the student government, but also the school governing bodies, on matters of the school. They also have constitutive powers and can, for example, be a party in establishing educational and preventative programmes of the school or institution (however, not a curriculum). Parent councils can also give opinions on key school documents, such as programmes, timetables or school laws, such as surveillance or pupils' attire. In Ireland, Parent Associations can also review policy issues and incidents that may require a change of school policy (e.g. bullying, homework, enrolment, or behavioural problems). In the Netherlands there are also optional Parent-Teacher Associations, with parents

who volunteer to support school activities, organise events and facilitate communication between parents, teachers and the school administration.

Parents also organise themselves on the regional or national level, forming associations based on common interests. For example, in Austria some associations include Umbrella Associations of Parents Associations for Compulsory Schools, gathering parents of children attending public schooling, the Federation of Catholic Parents' Associations organised by Catholic parents, or the Network of Free Schools of parents from alternative school concepts. Similar theme-oriented associations used to be popular in the Netherlands, but most were dissolved after the government appointed a national representative body, Ouders and Onderwijs. Now, the remaining parent organisations are Catholic.

Some countries also have nationwide parent organisations, which have a direct say in policymaking and governance. In Romania, the National Federation of Parents' Associations is a legal body and a support platform for all associations, representative councils, parents' committees and even individual parents whose children attend pre-university educational institutions. It is effectively involved – as an advisory body – in the analysis and debate of draft laws and regulations that concern decisions in the education act and in the promotion of legislative initiatives. The National Federation of Parents' Associations contributes to better quality and the modernisation of Romanian pre-university education in accordance with the standards of the European Union (EU). It is involved in supporting and promoting initiatives, projects, studies and successful methodologies of parents' associations and representative councils of parents, children, and teachers. In Germany, the national bottom-up organisation Bundeselternrat has significant political influence.

Parents' participation in educational laws also depends on the level of schooling. For example, in Germany, the degree and formality of parental involvement differ in daycares and kindergartens from that in primary and secondary education. This right of parents is reflected in the daycare and school laws, which grant them individual rights. These include, for example, the right of parents to receive information about their children and about their upbringing and education and, on the other hand, the right to be involved, which is reflected in their presence in the facilities, in their cooperation with the professionals, and in decision-making rights regarding their own children. Further participation and co-decision rights are regulated by the parent representation and participation committees in the schools and daycare centres, which are democratically elected and legitimised. At primary and secondary schools, parents' rights of participation, involvement and co-determination go beyond consultation and advisory rights, and parents' committees are institutionally more firmly anchored and have more far-reaching rights than in daycare centres. The school systems and the legal regulations of parental involvement are laid down in the respective school laws of the federal states. These differ mostly only in the details, and parental participation and the parental representation principle are reflected to some degree across all states.

Many educational and governmental policies formalise parents' rights to have a say in their children's schooling; the same goes for children having a voice in educational matters.

Students

Youth organisations are an important way of including children's rights in education and schooling. However, these are not always represented formally. Some can be informal and therefore have little say in the

curriculum, but a bigger say in everyday school policies. As in the case of parents, children can organise themselves within their school, in intra-school bodies and on a national level.

Student engagement within one school can create governments for each class and for the whole school. In Poland, the student engagement structure is similar to parents' engagement, as it involves three students in a class's 3-person government, acting as a class host (or president), deputy and treasurer. Class government representatives are also members of the school-wide students' government, a mandatory body in every public school in Poland. In the Netherlands, the representation of pupils on the school council is an essential aspect of the Dutch education system. Student governments are legally compulsory representative bodies. Students elect their peers to serve on the student government, which works closely with school administrators to address student concerns, advocate for student interests, and organise school events and activities. Student representatives engage in discussion with school administrators, teachers, and staff to provide feedback on issues that matter to the student community. The student government plays a crucial role in fostering student voice and encouraging leadership skills among the student body.

One of the core student engagement activities is associated with forming interest groups. In the Netherlands, there are various clubs and extracurricular activities that are usually optional for students to join. These clubs can range from sports teams to academic organisations, community service clubs or cultural groups. Extracurricular activities provide students with opportunities to develop specific skills, socialise, and build a well-rounded personality beyond the classroom setting. In Romania, some schools have student-led volunteer groups focused on community service and social initiatives. Schools can also support student publications, and in some schools students may run their own newspapers, magazines or newsletters, allowing them to express themselves and share information.

Some associations can also act as cooperatives, similar to cooperatives operating on the market. In Poland there are student cooperatives that bring together at least 10 students of a given educational institution, supervised by teachers. Such an organisation functions on the basis of a statute, and undertakes activities specified in the statute as the subject of the student cooperative activities. The activities of cooperatives include: organising the purchase and sale of goods, in particular health food, school supplies, and textbooks in the framework of the school store run by the cooperative; organising the purchase and sale of goods; the implementation of initiatives promoting healthy nutrition; the implementation of initiatives promoting environmental attitudes and activities; and carrying out small-scale manufacturing and performing services for the educational institution within which the cooperative operates.

Some schools that are connected via school networks or similar profiles form inter-school student partnerships. In Belgium (Flanders), inter-school associations bring students from different schools to work on common projects or interests. An example is the Student Council of Flanders, a bottom-up representative body comprising pupils in secondary education. Members of the student council learn everything about the rights and obligations of students. In addition, the Student Council of Flanders defends the interests of pupils in all Flemish schools.

There are also national-level student organisations. In Austria, there is a National Pupils' Representation that represents students' rights at a national level to the Federal Ministry of Education, Science and Research, other authorities, the National Council, the Provincial Councils and statutory interest groups. The National Pupils' Representation is composed of 27 Land school spokespersons and two representatives of the central teaching

institutions. The pupils' representation has the right to be heard, the right to be informed about all matters that concern pupils in general, the right to make proposals and statements, the right to participate in teachers' conferences and the right to have a say in the organisation of lessons. These rights are provided for from the 9th grade onwards. There is also an Austrian student parliament, where once a year students from all over the country decide on key demands for the government to realise. Annually, around 6–8 demands are presented to the federal teaching committee and subsequently presented, discussed, and possibly decided in the National Parliament. Germany also has local-level student authorities. Student councils can be formed at local authority (Kommunen), town or district level.

Student engagement can start at a very early stage and can be formalised. For example, in Belgium (Flanders) students are involved in decision-making, even in early primary education, through informal participation such as exchanging thoughts with a teacher or dropping ideas in a suggestion box. In higher primary school classes, pupils aged 11-13 can ask to form a student council. In secondary schools, the student council becomes more formalised and has more responsibility. It is worth mentioning that in most countries primary school students are only involved in student representative bodies at school level if at all, so their voice is mostly missing at national and even municipal level.

Although many regulatory entities operate on an inter-school level, there are also school networks that have an impact on curriculum decisions.

School networks

School networks are mandatory or voluntary networks of schools associated with the same educational values or same patrons. Some act as partnerships mainly in the administrative sense; however, in some countries they share curriculum frameworks across different schools.

Networks can be based on the funding of the school. For example, in Belgium, schools in Flanders have different education networks for public and private education. Belonging to one of these networks is compulsory. School networks 'translate' the national curriculum into their own curricula and implement them on the inter-school level. In Ireland, the school system is based on patronage – which means they are governed under the same ethos and same patron body. Patrons can be a religious community, a charitable trust, or a private charitable company. Irish Patrons are responsible for the curriculum, which can be individual for a single school or consistent across all schools under the same patronage.

Some school networks function more voluntarily and form inter-school associations. For example, networks of schools in Romania can facilitate less formal collaboration, information exchange, and joint activities among educational institutions. Optional voluntary associations can be subject-specific, focusing on promoting specific disciplines such as mathematics, language, arts or science. They may organise competitions, workshops and events to enhance students' knowledge and skills in those subjects. In Poland there are a number of non-traditional schools that organise themselves in associations: Eco-schools, the Association of Active Schools, and the Society of Creative Schools, which apply alternative forms of learning.

Interschool networks may also be based on their training role for teacher education. In the Netherlands there are Regional Educational Collaboratives, which are collaborative structures that are legally compulsory and aim to connect schools with teacher training institutions. The goal is to facilitate the training and professional

development of teachers by providing them with practical teaching experience in schools while collaborating with experienced educators.

Although schools are a core learning institution for children and young people worldwide, there are also a number of non-formal education providers who provide after-school care.

Non-formal educators

Open schooling, as one of the current priorities for educational policies in the EU, involves partnering with many non-formal educators in the educational system. Non-formal school education includes a variety of public, non-governmental and private institutions that offer extracurricular and recreational activities to students through open schooling. Non-formal education caters for different age groups, cohorts, and student interests. Non-formal educators have more freedom in choosing their activities as they don't follow formal curricula. They also often provide services within an open schooling partnership, for example catering for niche needs or the teaching of new content that teachers are not prepared for. Open schooling providers are crucial for providing expertise that schools lack for covering curricula.

Some of the non-formal education can be delivered in school, for example during after-school care. In Austria, some activities that require school property, for example the school community garden, are carried out during after-school care. Schools in Estonia also get external funding to include non-formal learning activities, such as field trips and theatre visits. Dutch schools also create student services and support networks, which may include academic support centres, counselling services, peer mentoring programs and anti-bullying initiatives. While some of these services might be legally compulsory, such as ensuring a safe and supportive learning environment, others could be optional, giving students access to resources according to their individual requirements. Some after-school programmes also target vulnerable and socially disadvantaged populations; for example, in Hungary these target Roma children. There are also open schooling partnerships supporting Roma children within school hours, but provided by an external actor.

However, most of the non-formal education is offered outside of school. Romania has a number of youth organisations that focus on personal development, leadership, civic engagement and social activities. They offer workshops, training programmes and camps to empower young people and foster their skills and talents. There are also NGOs dedicated to specific causes, such as education, environmental awareness, cultural exchange and social inclusion. They organise projects, workshops, and events to address societal challenges and provide learning opportunities. Many non-formal education programmes can be delivered by cultural institutions such as culture and art centres, libraries, museums and zoos. In Estonia there are also youth centres, especially in bigger cities, and organisations such as the Estonian Defence League and Scouts.

Adult education, including some vocational training, is also a big part of non-formal education. In the Netherlands, Lifelong Learning Centres offer non-formal education for adults, including professional development courses, vocational training and personal enrichment programmes. These centres enable adults to acquire new skills, update their knowledge and enhance their employability. Germany has a federal voucher programme that subsidises continuing education and many state-based efforts to promote adult lifelong learning, including employer benefits. There are also non-profit organisations that offer non-formal vocational education programmes, such as the SYNTRA network in Belgium that offers such courses in a variety of fields, including construction, healthcare and hospitality.

In addition to mostly not-for-profit non-formal education, businesses can also play an important role in education systems.

Business

Private companies can be involved in the education system. It is quite common in most of the countries examined to have different types of intersection between education and business. Most of these are on a voluntary basis.

The most common form of involvement of private companies is to seek future employees within the school system. This is especially prevalent through apprenticeships or vocational training. For example, in Belgium (Flanders) students can gain practical experience in their chosen profession while still in school. Companies can even scout for potential apprentices. In Poland, the education system obliges schools to collaborate with entrepreneurs specific to industry and trade. Technical schools' class profiles are often established to connect with local businesses and implement practice-based classes within the school, so specific business actors have an impact on the technical curriculum of class profiles. In Romania, a few companies can establish vocational training centres to provide specialised training and skill development in areas related to their sector.

Some businesses participate in the education system through know-how or material donations. In Hungary, some companies collaborate with schools as part of their CSR programmes, for example by organising charities or school trips, or donating used equipment to schools. In the Netherlands, CSR programmes can also be provided through the funding of school projects or sponsoring of educational events and initiatives. In Romania, some private companies also create scholarship programmes as part of their CSR.

Another form of collaboration can be found among entrepreneurs, for example start-up incubators and accelerators. In Romania, these support young entrepreneurs and start-up companies through collaborating with educational institutions to offer mentorship, networking opportunities, and business development programmes. The Netherlands has a vibrant start-up ecosystem, and some start-ups focus on developing innovative educational solutions. These companies may collaborate with schools to pilot and implement new teaching and learning methods.

Chambers of Commerce are consulted and have a direct impact on curricula on the national and lower levels in some countries, including Austria and Hungary. The local Chamber can ask to become a school board member in Hungary, with equal representation.

In addition to all the actors listed above, there are also religious entities that play a crucial role in the education system.

Religious organisations

Religious entities can also have an impact on the education systems and curriculum development and implementation. They can also dictate, to some extent, how the curriculum adheres to religious dogmas.

Many countries also have a strong link between religion and education systems. In Ireland, each school is under the authority of a 'patron', and about 90% of primary schools and 48% of secondary schools are under the patronage of the Catholic church. In the case of Catholic and Church of Ireland schools, the owners are usually the diocesan trustees. Since the patron of the school sets the ethos and appoints the Board of

Management, they play a significant role in the school system. There has been criticism of exclusionary practices in the Catholic education system in Ireland. The practice of prioritising baptised children in school enrolment (often called the 'baptism barrier') is now illegal in most schools. This means that many schools that are under the patronage of a specific Church can have students attending who are not members of this Church. In the Netherlands, religious schools are affiliated with various religious denominations, such as Christianity (Catholic, Protestant, etc.), Islam, Judaism, Hinduism, and others. Religious schools are governed by school boards associated with religious institutions or organisations, and they often employ teachers and staff who align with the school's religious principles and values. These educators may be members of the religious community or individuals with a strong commitment to the school's faith-based education. In Austria, religious education is an important aspect of the education curriculum. Students have the option of receiving religious instruction in their respective faiths (Catholic, Protestant, Islamic, Jewish, etc.) or attend ethics classes. Religious education is provided, managed and directly supervised by the respective legally recognised Church or religious society. Religious communities have the right to establish religious education in public schools and operate private schools that incorporate their religious beliefs and practices.

Many of the actors involved in the education system often act independently or are hierarchically linked, yet there are not enough equal collaborative bodies formed.

Collaborative bodies

Although the activities of most actors in the education system are interdependent, many of them act independently and don't create collaborative entities. There are several good practices studied across countries that show the benefit of mobilising collective efforts instead of acting separately.

Some schools have internal school joint committees, which combine different school-specific actors into one collaborative body. In Poland, the school council is a social body appointed under the Education Law by the school head; its task is to participate in resolving the internal affairs of the school. It is an optional body; when it has not been appointed, its powers are exercised by the teaching council. The school council may be established on the initiative of two bodies from the school's teaching council, the parents' council, and the student government. The council is composed of at least 6 persons, elected in equal numbers from the teaching staff, the entire student parents, and the entire student body. The school council adopts the school statute based on the project prepared by the teaching council, proposals for the annual financial plan, and gives its opinion on the work plan, projects of pedagogical innovations and experiments. The school council may, on its own initiative, assess the situation in the school and submit relevant motions to the school management and its requests to the authority in charge of educational supervision to examine and evaluate the activities of the school, its school head, or other teachers.

In some countries, how schools are run is based on several collaborative bodies. In Austria, there are two bodies: the school forum (consisting of teachers and parents) and the school community committee (consisting of students, parents, and teachers). The committee can decide on the choice of textbooks, can book workshops and excursions, and bring NGOs to schools. The committee not only has decision-making but also advisory powers. Committees are also responsible for school-autonomous curriculum regulations. In Belgium (Flanders), a similar body called the school council includes representatives of parents, staff, and the local community, and – from secondary education onwards – also students. The school council consults with another collaborative body, a school board, consisting of representatives of the school administration,

teachers, parents and students. The school council can also give advice to the school board on its own initiative. School council advises on decisions that concern staff, parents or students, such as changes to the school regulations or the study offer, major renovations, welfare policy or health policy. The school board has a responsibility for the forming, adoption and revision of the school's educational programme that contains the local curriculum.

Collaborative bodies can also be formed in the school networks. In Ireland, there is a Green Schools Programme, which is Ireland's leading environmental management and education programme for schools. Green Schools Committees are responsible for leading the programme in their school. The committee is student-led but must have at least one teacher or staff member. Many schools have elections of representatives, but some involve all interested students. Schools are encouraged to include other staff members or parents with relevant skills or interests to support the committee's work.

There are also collaborative advisory bodies on the national level. In Romania, the National Council of Education is an advisory body to the Ministry of Education. It is composed of representatives from various stakeholders in education, including teachers' unions, parent associations, and student organisations. The Council discusses and provides recommendations on education policies and reforms.

Collaborative bodies that involve all actors with equal weight have much untapped potential for making good changes to certain outdated procedures in the education system. However, the existing provisions are often already so deeply rooted that reinventing collective obligations, rights, and responsibilities may prove very difficult.

3. Procedures for introducing new content into schools

In the endeavour to introduce new content into schools, including that related to bioeconomy, a nuanced understanding of the procedures and methodologies is imperative. Across different countries, diverse procedures exist pertaining to the integration of novel educational content into school curricula.

Simplifying this, one can categorise these procedures based on the primary actors in the process, by distinguishing those within the purview of teachers, schools or school heads, as well as oversight bodies and policymakers at the central level. However, the above classification overlooks the roles played by students, parents, non-formal educators, and other entities in this process – a topic addressed in an earlier chapter of this report.

This chapter synthesises the procedures present in the consortium of BioBeo partner countries, thereby creating a blueprint beneficial to all those seeking to introduce new content, including the BioBeo curriculum, into schools. Emphasis is particularly placed on solutions that support innovative governance in education.

Procedures in the hands of teachers
Through hours not covered by the standard curriculum

Educators may incorporate new content within the allotted hours not covered by the standard curriculum, such as in Poland's case, during homeroom periods. Such a period (known as *godzina wychowawcza* in Polish) is a designated time slot within the school timetable specifically allocated for non-academic activities and guidance. The homeroom period is implemented by the class teacher.

Advantages of this approach include the absence of formalities and increased flexibility. The flexibility of homeroom periods makes them a valuable slot for introducing new content, such as subjects related to bioeconomy or any other non-traditional topics, as it allows for a more informal and interactive approach to learning.

However, notable drawbacks accompany this method. The limited number of available hours poses a challenge, restricting the depth of coverage. Additionally, the lack of dedicated funding, training and organisational support presents further obstacles. This approach may also be characterised by its short-term nature, requiring careful consideration of sustained impact and long-term educational benefits. As the homeroom period is implemented by the class teacher, this is not always (or may even only rarely be) a teacher who specialises in the subject we actually want to introduce into schools – such as bioeconomy.

Through the framework of existing subjects

Teachers have the flexibility to introduce new content within the framework of existing subjects covered by the curriculum. In Poland, for example, school heads and teachers revealed in interviews that approximately 10% of the time allocated to a specific subject can be modified by the teacher without adversely affecting the concurrent implementation of the core curriculum. However, there is a recognition of the potential threat of scrutiny by governing bodies and superintendencies in response to such modifications. This oversight factor tends to favour the formal route for introducing new content, as concerns may arise from students, parents, or spontaneous inspections initiated by authorities.

Nevertheless, not all countries provide teachers with the space to introduce new content. In Austria, for instance, curricula are highly detailed in specifying what contents must be taught and how lessons should be organised, leaving limited room for instructional modifications.

Similarly, in Greece the theoretical freedom granted to teachers is often constrained in practice. Although the curriculum acknowledges the teacher's options and some degree of freedom in applying methodology and introducing new content, the prevailing tendency is for teachers to adhere closely to the prescribed school textbooks. Notably, there is limited autonomy in selecting textbooks, as proposals for new textbooks were considered in 2023, aiming to provide teachers with more choice, but the extent of this freedom remains constrained.

The ease of introducing new content is notably greater at lower levels of education, where the degree of freedom is more pronounced and the curriculum is less densely packed. In many countries the early years of primary school are characterised by undivided learning or minimal subject differentiation, making the introduction of new content more straightforward. In the first grades of primary school, subjects are often not distinctly separated, or the division is minimal. This environment facilitates the introduction of new content, allowing for a more integrated and interdisciplinary approach. The absence of rigid subject boundaries provides educators with greater flexibility to infuse diverse topics, such as bioeconomy, into the curriculum.

Similarly, in preschool settings, introducing new content is relatively straightforward when it aligns with educational areas delineated in the curriculum. For instance, in Germany the curriculum may include areas like 'nature and cultural environments', while in Austria there may be a focus on 'nature and technology'. Bioeconomy, for example, fits into these educational domains, offering educators the opportunity to seamlessly incorporate it into the learning experience.

Procedures in the hands of schools or their school heads

Through hours designated for school heads

One avenue for introducing new content is by utilising hours designated for school heads, such as in Poland's case, during 'director's hours'.

The advantages of this approach include minimal formalities and increased flexibility. These hours, though limited, can be dedicated to activities fostering students' interests and talents, particularly those related to cultivating their initiative and creativity. The selection of activities is intended to be student-driven, with the understanding that each student may choose from the available classes. While not mandatory, the school head is obligated to organise these classes to address the diverse needs of the students. It is crucial to note that these hours fall outside the realm of compulsory educational activities.

Activities conducted during director's hours, designed to enhance students' creativity, are voluntary, exempt from mandatory evaluation, and do not contribute to the formal grading system or school diploma. Various classes may feature distinct activities, and the formation of inter-class groups is possible. Group organisation should cater to the students' age, needs, and educational opportunities, ensuring a beneficial and adaptable structure.

It is important to acknowledge that the regulatory framework places limitations on the number of director's hours. In primary school, for instance, education stage 1 (grades 1-3) allows for 3 hours per week at the school head's disposal, while education stage 2 (grades 4-8) provides 4 hours. In reality, school heads highlight that these hours are often redirected towards better preparing students for external exams, emphasising a potential drawback to making use of the director's hours for introducing innovative content.

Through school-based curriculum

Introducing new content within a school-based curriculum is most effective when schools have decentralisation and substantial autonomy. Notable examples that exemplify this approach are to be found across Europe, for instance in Flanders, Austria, Germany and Romania.

In Flanders, school governing boards take on a significant role, holding responsibility for one or more schools. These boards enjoy extensive autonomy, taking independent decisions on critical aspects such as teaching methods, philosophical approaches, curricula, timetables, and staff appointments. The government's involvement is limited to setting conditions for school recognition and providing financial support. This decentralised structure empowers schools to tailor their educational offerings according to local needs and preferences, fostering a dynamic and responsive learning environment.

Similarly, Romania demonstrates the benefits of decentralisation within its educational system. A significant approach to enhancing students' knowledge and broadening their horizons involves the introduction of dedicated hours through the School-Based Curriculum (Curriculum by School Decision [CDS]; see box on p. 18). True to its name, each school has the authority to incorporate various such curricula into its educational offerings, tailoring them to the specific needs and interests of its student body.

The optional subjects offered at the school level must adhere to specific criteria. Schools must ensure the diversification of learning activities based on the needs and aspirations of the students. Subjects must derive from any of the educational subjects, thereby constituting an educational offer that caters to student interest

in a particular field of study. Introduction of a new subject, in addition to those outlined in the common core curriculum, requires it to be structured around an integrating theme for a specific curricular area or across multiple curricular areas.

The design of the school-based curriculum is crafted with consideration for the students' interests, the human and material resources of the school, and the needs and specificities of the local community.

This curriculum can manifest in different forms. It can be an in-depth curriculum, extended curriculum, or optional curriculum. Firstly, an in-depth form of CDS aims to deepen the reference objectives of the core curriculum by introducing new reference objectives and content units within the maximum number of hours allocated to a subject. Deepening is applied primarily in cases of catch-up, targeting students who have not attained the minimum level of the curriculum objectives in previous years. Secondly, for general education, an extended form of CDS seeks to extend the objectives and contents of the core curriculum by introducing new reference objectives and content units within the maximum number of hours allocated to a subject. It encompasses the full curriculum. Finally, optional curriculum, which is structured as a new school subject with aims and content distinct from the compulsory curriculum corresponding to the common core. It allows for a tailored approach to meet the diverse interests and needs of students beyond the mandatory curriculum.

The process of introducing CDS into the classroom in Romania involves a structured series of steps that ensure careful planning, assessment, and approval at both national and local levels.

1. Preparation:
a. Analyse present and future needs of enrolled students.
b. Identify local community expectations.
c. Assess human and material resources within the school.
d. Analyse needs and opportunities specific to the local cultural, social, and economic context.
e. Receive CDS proposals from teachers and parents' committees.
f. Inform and involve students.
g. Conduct consultations with parents.
h. Appoint the team and establish the timetable.
i. Develop the CDS programme.

2. National Approval:
a. Curriculum proposals must meet quality criteria set by the Ministry of Education.
b. Proposals, accompanied by a justification note, are submitted to the Ministry of Education for verification.
c. Ministry specialists review the proposals and prepare an expert report.
d. The draft school curriculum is then submitted to the National Specialised Commission, along with the expert report.
e. The National Centre for the Development of Vocational and Technical Education approves the curricula and submits them to the Ministry of Education for final approval.
f. National specialist commissions provide advisory opinions on the proposed curricula for the national offer.

3. Local Approval:
a. Teachers develop curricula for subjects/fields of study and optional training modules.
b. The School Board submits the set of curricula to the County School Inspectorate and requests an academic opinion.
c. After obtaining the academic opinion, the School Board approves the school programmes for optional subjects to be studied in the following school year.
d. If a programme does not receive academic approval, it may be revised based on recommendations.
e. The author may seek support from the head of the department/ methodology committee for revisions.
f. The process repeats until academic approval is obtained.

4. Inclusion in a School's Educational Offer:
a. Each school independently establishes the CDS for the following school year.
b. The curriculum is endorsed by methodological committees/teaching staff and approved by the Teaching Council and Administrative Board.
c. Dissemination of the school's optional offer is followed by centralisation of students' choices and parents' signatures.
d. The elaboration of school programmes must adhere to the specific structure of the national curriculum.

In addition to central and county institutions, educational establishments, NGOs and public cultural institutions can propose CDS at the national level, contributing to the enrichment of educational offerings.

In Austria, the implementation of school-autonomous curricular regulations falls under the purview of the school forum or the school community committee. This process involves several key steps:

1. The school forum or school community committee is responsible for enacting school-autonomous curricular regulations.

2. The school-autonomous curricular regulations must be publicly announced by posting them for a period of one month.

3. After the one-month period, the regulations must be deposited with the school management.

4. Pupils, guardians, and (in vocational schools) teachers are granted the right to inspect the school-autonomous curricular regulations upon request.

5. School-autonomous curricular provisions are communicated to the competent school authority.

6. The competent school authority has the power to revoke school-autonomous curricular provisions if they do not comply with the authorisation or if the interests of pupils and guardians, beyond those of the individual school, have not been adequately considered.

7. School-autonomous curriculum provisions that necessitate additional personnel or equipment resources compared to the prescribed curriculum require the approval of the competent school authority.

This process ensures that school-autonomous curricular regulations undergo a transparent and accountable procedure, involving the school community, and are subject to scrutiny by the competent school authority to safeguard broader educational interests.

Schulprogramme are school programmes that define the educational goals, methods, and evaluation criteria for each school in Germany. They are developed by the school staff in cooperation with the school administration, parents and students, and are based on the state curriculum and guidelines. *Schulprogramme* aim to improve the quality of teaching and learning, as well as the school culture and climate. The right and/or the obligation of the schools to pass, implement and evaluate specific *Schulprogramme* has brought about new duties especially for the head teacher. As part of securing the quality of the lessons, the head teacher is additionally responsible for lesson development, staff development and organisational development as well as for the planning of further training, staff management and, where applicable, for the administration of budgetary funds.

All four regions – Flanders in Belgium, Romania, Germany and Austria – embrace decentralised approaches to some extent, granting schools autonomy in curricular decisions. This autonomy allows for flexibility in introducing new content, including subjects related to bioeconomy. However, along with this commonality, each approach has its unique characteristics.

One notable advantage across these regions is the emphasis on involving local stakeholders, including teachers, parents, and the school community, in the decision-making process. This ensures that the introduced content aligns with the specific needs and expectations of the students and the local context. The flexibility provided by decentralised approaches allows schools to tailor curricula to meet the demands of their communities, fostering a more responsive and relevant educational experience. Furthermore, the

engagement of competent authorities in the approval process, as seen in Austria and Romania, adds a layer of oversight ensuring that the introduced content adheres to broader educational standards.

However, a common challenge shared by these approaches is the potential for inconsistencies in educational standards and offerings across different schools. The decentralised nature may lead to variations in the depth and quality of education, posing a risk of educational disparities. Additionally, bureaucratic processes involved in the approval and enactment of curricular changes, as observed in Romania and Austria, may introduce complexities and delays. While it is true that even in the most centralised systems these differences exist, striking the right balance between autonomy and standardised education is crucial to avoid potential drawbacks. Heavily standardised education is nowadays seen as an outdated approach that doesn't provide enough flexibility to cater for the needs of the students attending the school, but well defined outcome requirements remain key to ensuring quality of education.

In conclusion, decentralised approaches offer more opportunities for schools to introduce new content, but careful consideration is needed to address challenges such as maintaining educational standards, ensuring transparency, and streamlining approval processes. These approaches can serve as valuable models for fostering innovation in education while maintaining a balance between autonomy and accountability.

Through short courses

A way to introduce new content into schools could be through short courses, blocks of classes whose duration would depend on the needs, but shorter than one semester.

An interesting example of the integration of specialist short courses into the curriculum is the Irish Junior Cycle Curriculum – the curriculum for the first three years of post-primary education in Ireland. It is based on the Framework for Junior Cycle, which was published by the Department of Education and Skills in 2015. The framework aims to provide students with a broad and balanced education that develops their knowledge, skills, values, and attitudes for lifelong learning. It also offers a range of subjects and short courses that cater to the needs and interests of students and communities.

Short courses are optional courses that require 100 hours of student engagement over the three years of junior cycle. They are designed to allow schools to offer a more diverse and flexible junior cycle programme that meets the challenges and opportunities of the 21st century. They also aim to broaden the learning experiences of students and enable them to explore areas of learning that are not fully covered by the core subjects – such as bioeconomy.

Seven short courses have been developed by the National Council for Curriculum and Assessment (NCCA) as outlined here: Coding; Digital Media Literacy; Artistic Performance; Chinese Language and Culture; Social, Personal and Health Education (SPHE); Physical Education (PE); and Civic, Social and Political Education (CSPE). None of the above refers directly to the bioeconomy, although elements of it may find their way into some of them.

Schools can also develop their own short courses or use short courses developed by other organisations, following the guidelines and template provided by the NCCA. The provision of short courses in schools depends on various factors, such as the design and content of the school's junior cycle programme, the resources available, the students' needs and interests, teacher availability, expertise and qualifications, the views of parents and guardians, and the integration of short courses into the school timetable. Schools are advised to

limit the number of short courses they offer, especially in the early years of the implementation of the Framework for Junior Cycle, and to ensure that short courses do not replace existing subjects.

Moreover, the European Union's education landscape is embracing the concept of micro-credentials,[1] presenting a novel approach to curriculum expansion through short courses. These focused learning experiences, frequently delivered online, culminate in stackable certificates that can be integrated into traditional diplomas. Notably, micro-credentials cater to specific skill development or niche knowledge areas, typically demanding learning time equivalent to a designated number of ECTS (European Credit Transfer and Accumulation System) or ECVET (European Credit system for Vocational Education and Training) points (one point typically corresponding to 25-30 hours of learning). This framework presents a promising avenue for enriching school curriculums while fostering a culture of lifelong learning within the EU. Micro-credentials are now one of the most important topics in the education debate in some countries, for example the Netherlands.

Through pedagogical innovations

Pedagogical innovations are an essential part of the educational policy and practice in Poland. They allow schools to introduce new content that is relevant, engaging and challenging for their students and communities. They are defined as any innovative curricular, organisational or methodological solution aimed at improving the quality of schoolwork. Pedagogical innovations can be initiated by schools themselves, based on their own needs and interests. They have a high degree of autonomy and flexibility in introducing pedagogical innovations, as long as they follow certain basic principles and requirements, such as:

- the innovation must be consistent with the core curriculum and the educational standards;

- the innovation must be approved by the school head and the teaching council;

- the innovation must be voluntary for teachers and students (with written consent);

- the innovation must be evaluated and reported by the school;

- the innovation must not infringe on the students' right to free education, upbringing and care.

The regulation also distinguishes between three types of pedagogical innovations: curricular, organisational, and methodological. Curricular innovations involve changes in the content, scope, or sequence of the curriculum, such as introducing new subjects, modules or topics. Organisational innovations involve changes in the structure, organisation or management of the school, such as creating new forms of classes, groups or teams. Methodological innovations involve changes in the methods, techniques or tools of teaching and learning, such as using new technologies, media or materials.

The procedure of pedagogical innovations in Poland is based on the internal procedures of the school, which means that the school itself decides what innovations will be implemented, and how they will be implemented and evaluated. The school head is responsible for initiating, coordinating, and supporting the pedagogical

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[1] A micro-credential is a proof of the learning outcomes that a learner has acquired following a short learning experience. These learning outcomes have been assessed against transparent standards. The proof is contained in a certified document that lists the name of the holder, the achieved learning outcomes, the assessment method, the awarding body and, where applicable, the qualifications framework level and the credits gained. Micro-credentials are owned by the learn er, can be shared, are portable and may be combined into larger credentials or qualifications. They are under pinned by quality assurance following agreed standards (European Commission 2020).

innovations, as well as for applying for funds if needed. The teaching council is responsible for approving, monitoring, and reviewing the pedagogical innovations, as well as for providing feedback and recommendations. The teachers are responsible for participating, implementing, and reporting the pedagogical innovations, as well as for developing their professional competences. The students are responsible for engaging, learning, and evaluating the pedagogical innovations, as well as for expressing their opinions and preferences. The school's governing authority and the superintendent of education are not directly involved in the procedure of pedagogical innovations, but they can provide guidance, advice and recognition if requested.

The procedure of pedagogical innovations in Poland offers many opportunities for introducing new content into schools. New content can be introduced in various ways, depending on the type, level, and objectives of the innovation. For example, new content can be:

- a new subject or module that covers a specific area of knowledge or interest, such as bioeconomy, robotics or entrepreneurship

- a new topic or theme that integrates different subjects or disciplines, such as climate change, human rights or cultural diversity

- a new perspective or approach that challenges the existing assumptions or practices, such as critical thinking, inquiry-based learning or cooperative learning

- a new resource or material that enhances the learning experience or outcomes, such as digital tools, multimedia, or authentic texts

Despite these theoretical opportunities, serious issues exist in Poland related to the financing of innovations. The work of preparing the innovation, and the increased workload in implementing it, is not formally paid extra. Teacher salaries in Poland are low (a beginning teacher's salary almost equals the minimum wage), and this has been the subject of public debate for years. At the same time, in terms of introducing innovations, the school head only has the option of modifying the incentive allowance in the case of a teacher who devotes his time and energy to it. The incentive allowance is usually between EUR 25 and 125 per month. Therefore, a teacher who introduces an innovation may experience a real salary increase of at most EUR 100 per month, and in practice most often less.

Due to the elimination a few years ago of the obligation to register innovations with the superintendency, it is difficult to assess the scale of the use of this path. School heads in interviews indicate that 1–3 innovations are usually carried out in the school. However, these are usually no-cost and low-effort innovations.

Procedures in the hands of leading authorities or government

Some procedures cannot be carried out solely within the autonomy of the school or teacher, and require the involvement of the leading authority at local level, or even central government.

Through pedagogical experiments

In some countries, such as Poland and Austria, it is possible to conduct a so-called pedagogical experiment. A pedagogical experiment consists of the modification of existing or implementation of new activities in the educational process, with the application of innovative curricular, organisational, methodical, or educational

solutions. The purpose of the pedagogical experiment implemented in a school or institution is to develop the knowledge competence of students and teachers.

In Poland the pedagogical experiment has to be an innovative activity and is often somewhat more long-term in nature than the pedagogical innovation described earlier (although still limited). On the other hand, it involves formalities and extra work for the teacher, and does not include assured funding or organisational support. The pedagogical experiment is to be conducted under the supervision of an academic institution (University or similar).

It may cover the whole school or institution, a department, a group or selected educational classes. Conducting a pedagogical experiment at a school requires the approval of the Ministry of Education. The school head, based on a resolution of the Teaching Council and after obtaining the opinion of the Parent Council, shall apply to the Ministry of Education for permission to conduct a pedagogical experiment at school, by March 31 of the school year preceding the school year in which the experiment is planned to start. This application shall be submitted through the Superintendent of Education. If the Pedagogical Experiment requires the school to be allocated additional budget funds, the application shall be accompanied by written consent of the school's governing authority to finance the planned activities. Immediately following the completion of the pedagogical experiment, the school head shall submit to the Ministry of Education a report on its conduct, together with the opinion of the academic unit supervising the course of the experiment. The report is also handed over to the school's governing authority and the authority that exercises educational supervision (Superintendent of Education).

In Austria the competent Federal Minister may carry out school experiments at certain public schools for the purpose of testing special educational or school organisational measures. Each school experiment is based on a school experiment plan which determines the objective of the school experiment, the details of its implementation and its duration. The duration of a school experiment may not exceed the number of grades of the school at which the school experiment is conducted plus two school years. A one-time extension by two additional school years is permissible. After expiry of the duration specified in the school experiment plan, the school experiment is transferred to the regular school system according to the achievement of the objectives. Before a school experiment is carried out at a school, the school forum, the school community committee, or the school cluster advisory board must be consulted. School experiments are prescribed by the Federal Minister or approved at private schools. The school partners, however, have the right to express an opinion within the framework of the hearing when school experiments are approved. In addition, at least two thirds of the legal guardians or pupils as well as the teachers of each school or class at which the school experiment is to be carried out must agree. School experiments may only be carried out at up to 5% of the classes in schools.

At Austrian academic upper secondary schools, pilot projects for the further development of lower secondary education can be conducted in order to postpone a decision on the educational career path. They should be set up by the competent Federal Minister upon application by the Directorate of Education and include all lower secondary schools. The competent Federal Minister may, on the basis of the application of the Directorate of Education, issue the model plans regulating the details of the implementation of the application. The model plans are announced in the schools concerned by posting for one month and subsequently deposited with the school management. Pupils and guardians are allowed to inspect them on request. Each pilot scheme for the individualisation of educational careers needs to relate to clearly defined school locations

and covers a period of four years. Model experiments may only be set up at a general secondary school if the guardians of at least two-thirds of the pupils and at least two-thirds of the teachers of the school concerned have agreed to the model experiment.

Through curriculum change

New content can, of course, also be introduced through curriculum revision procedures at national level. The advantages of such a route include the long-term nature of such changes, their broad scale and the funding and organisational support provided. The main disadvantages are the practical and political difficulties of implementing change due to both local circumstances and the requirement for stability of the curriculum and education system. Often such changes are also characterised by a lack of flexibility as a centralised solution.

The update of the curriculum can depend on a variety of factors, such as market needs, EU priorities, or political goals. For example, the curriculum may be updated to reflect the changing needs of the labour market, to comply with new EU regulations, or to reflect the priorities of a new government. The procedures for changing the curriculum are complex and vary greatly from country to country, so here we will only look at selected features of this way of introducing new content.

Different EU countries have different approaches and strategies for updating their curricula, depending on their political, administrative and educational contexts. Some countries, for example Germany, have a decentralised system where the curriculum is developed and implemented at the regional level, allowing for more flexibility and diversity. Other countries, such as Hungary, have a centralised system whereby the curriculum is determined and revised by the national government, ensuring greater coherence and consistency. Some countries, such as the

> The usual procedure of developing a new curriculum in Austria consists of the following steps:
>
> 1. The Federal Ministry for Education, Science and Research decides a new curriculum has to be created.
>
> 2. Experts from universities and colleges, etc., formulate the first draft.
>
> 3. The first draft is sent abroad and to experts in different fields. It is elaborated over 6-7 rounds of feedback.
>
> 4. The ministry sends out the finished document to universities, educational science faculties, teacher training colleges, teacher representatives, pupil representatives, unions, religious organisations, education directorates and parents' representatives. Over the next 3-4 months these communities' remarks are collected.
>
> 5. The review outcomes are forwarded to the curriculum creation committee (*Lehrplanerstellungskommission*).
>
> 6. The final version is presented in parliament to be decided. If it is successfully accepted:
>
> 7. New school books are developed on the basis of the new curricula by expert commissions. This process takes about one year.
>
> 8. Teaching staff learn about innovations through training and teacher training colleges adapt their education programmes for teachers.
>
> 9. Directorates of Education are tasked with ensuring that the curricula (contents, timetables, etc.) are implemented by the schools and teachers.

Netherlands, have a hybrid system where the national government sets the core objectives and standards, while the schools and teachers have autonomy and are responsible for designing and delivering the curriculum.

The process of curriculum change also varies in terms of the frequency, scope, and speed of the revisions, as well as the degree and mode of consultation and participation of different stakeholders. Some countries, such as Greece, have a long and infrequent cycle of curriculum reform, while others, such as Hungary, have a shorter and more regular cycle of curriculum review and development. In certain countries, such as Poland, there is a top-down and politicised approach to curriculum change, while in others, such as Germany, the approach is

bottom-up and collaborative, and involves associations, universities, and parents' and pupils' representative bodies. The challenges and opportunities of curriculum change depend on the balance and alignment of these different dimensions and factors.

Through cross-curricular topics

So-called cross-curricular topics, present in some countries, are an interesting element where interdisciplinary content, such as bioeconomy, can be introduced into the curriculum. The cross-curricular subject focusing on education for sustainable development present in German, Austrian and Estonian curricula can serve as an example.

Within the scope of the United Nations' World Decade of 'Education for Sustainable Development', in June 2007 the Standing Conference and the German Commission for United Nations Educational, Scientific and Cultural Organization (UNESCO) – Deutsche UNESCO-Kommission (DUK) adopted a joint recommendation with regard to 'Education for sustainable development at school' (*Bildung für nachhaltige Entwicklung in der Schule*). Also in June 2007 the Standing Conference and the Federal Government published a Cross-Curricular Framework for Global Development Education (*Orientierungsrahmen für den Lernbereich Globale Entwicklung*). This cross-curricular framework can be taken as a basis for the development of the curricula, teacher training and work in schools. The revised version of the cross-curricular framework of June 2015 provides concrete recommendations for the inclusion of sustainable and global development topics in the curricula of almost all subjects (natural sciences, foreign languages, mathematics, German, art, music, sports, politics, economics, religion, ethics, geography) and shows what pupils can learn in class where there is instruction in these topics. The cross-curricular framework hereby aims to empower the individual to play an independent and responsible role in shaping the individual and social challenges of the future.

Similarly, in Austria the umbrella topic of 'Environmental education and sustainable development' has to be integrated in a variety of subjects (mathematics, German, etc.) and the curriculum provides details on which contents of each subject should be linked with it. The curriculum of Compulsory Middle Schools defines this overarching, cross curricular-topic topic in the following way: "Education for sustainable development must be a general concern and guiding principle to be seen throughout school. For integrative thinking of the ecological, economic and social dimensions, then subject-specific as well as cross-curricular references are of great importance. Education for sustainable development, political education with its global Perspectives, Global Citizenship Education, Peace Education and Human Rights Education as well as other comprehensive topics are educational concepts that complement each other and prepare students for sustainable development in all its dimensions. In the learning process, knowledge, skills and abilities, values and attitudes should be developed that enable young people to cope with the social and economic challenges and to take an active role in ecological challenges, from the local to the global level."

Through small-scale educational programmes in cooperation with LRAs and leading authorities

Cooperation with LRAs and leading authorities can be a good alternative to difficult-to-implement changes at the central level. Examples can be found in Hungary and the Netherlands.

Teachers and local communities in Hungary have the freedom to organise or participate in environmental education programmes and many local governments support such small-scale initiatives. The best solution for

introducing new content this way is to approach schools offering them materials, lesson plans, training and workshops. Other good entry points are churches and private schools, which are usually the main hubs for pedagogical innovation in Hungary.

In addition to the curriculum, schools in the Netherlands offer a variety of programmes that are delivered outside of the curriculum. These programmes can be offered by the school itself, by external organisations, or by a combination of both. The content of these programmes can vary widely, but they often focus on topics such as entrepreneurship, on science, technology, engineering and math (STEM) education, or on social-emotional learning. The process of introducing new content into these programmes is similar to the process of introducing new content into the curriculum. However, it is important to note that these programmes are not subject to the same level of regulation as the curriculum. This means that schools have more flexibility in terms of the content and the methods that they use.

Other procedures

As a final note, we would like to mention two procedures, or rather two institutional arrangements, which are interesting and at the same time escape the categorisation we have adopted as the basis for this chapter – 'Transition Year' in Ireland and *Berufsschulen* in Germany.

In Ireland, after completing the Junior Certificate Cycle students may either move on directly to the Leaving Certificate Cycle (2 years) or attend a 'Transition Year'. This is an optional year that sits between the two cycles. The curriculum for Transition Year is not linked to any state examinations, and is often used as an opportunity for students to try different subjects and learn in different ways. If they take part in transition year, they will then move on to the Leaving Certificate Cycle. At the end of this two-year cycle most students undertake the Leaving Certificate State Examinations (aged 17 or 18). This completes their secondary education. The results of their Leaving Certificate exams will play a large role in their immediate options if they wish to take part in further education. Transition Year, because of its universality, institutional legitimacy, and the flexibility it provides, seems to be the ideal time to introduce new, innovative content into schools.

Berufsschulen are vocational schools in Germany that provide dual education for students who want to pursue a career in a specific trade or profession. They combine theoretical instruction at school with practical training at a company or organisation. *Berufsschulen* offer a wide range of programmes, from technical and commercial to social and health-related fields. Students can obtain various qualifications, such as a vocational certificate, a higher education entrance qualification, or a professional diploma. *Berufsschulen* are constantly adapting their curricula and methods to meet the changing demands of the labour market and society.

In order to be able to cater for specific local needs, the organisation of lessons in *Berufsschulen* is left up to the Länder and thus the schools. In principle, the way lessons are organised in the *Berufsschule* is chosen in close cooperation with the chambers or guilds and the companies within the catchment area. Flexible regulations thereby allow a number of different temporal organisational forms aimed at optimising the learning phases in the company and in school. This setup – though limited to vocational education – has similar strengths to Ireland's Transition Year, making it an excellent environment for introducing new content, including bioeconomy, into schools.

It is also worth considering what the EU can do for introducing new, bioeconomy-related curricular items. As part of the European Green Deal, green initiatives became part of the European Union's education package

on the European Education Area 2025 (EEA). Through this initiative, the European Commission wishes to have a major impact on education policy change and make member states implement certain policies one-by-one to make them EU-wide. Green initiatives are now also part of the package.

However, since education remains a national competence, the EU has limited means to support the curricular changes, mostly offering guidance, opportunities for sharing experience, and financial incentives. In the field of green initiatives the EU is using its regular methods to incentivise change:

- There is a related Council Recommendation (The Council of The European Union, 2022 – 2022/C 243/01) and the 'GreenComp - The European sustainability competence framework' (Bianchi, Pisiotis & Cabrera Giraldez 2022) has been developed, both published in 2022.
- The EU plays an important role in knowledge and practice sharing. In this case, they have created a hub for interested educators, and also share material already available – https://education-for-climate.ec.europa.eu/community/.
- As part of the Open Method of Coordination, there is a dedicated Working Group on the topic of education for sustainable development, but other EU education Working Groups are also dealing with the topic.

Last but not least, the allocation of EU education funding is supporting the transition by offering opportunities for developing, piloting and upscaling relevant educational tools. Green topics constitute one of the transversal areas of Erasmus+. In the current programming period (2021-27), a specific format is offered for curriculum development. The opportunities are not restricted to the usual opportunities for mutual learning in mobility or strategic partnership programmes. In the so-called Alliances for Innovation, one of the funding strands (Alliances for Sectoral Cooperation on Skills) specifically focus on designing European sector-wide core curricula and training programmes.

4. Barriers to introducing new content into schools

In the realm of the educational environment, the integration of new content into curricula encounters a complex interplay of obstacles and challenges. Within the institutional framework, a combination of legal considerations, organisational dynamics and socio-economic realities converge to shape opportunities for educational innovation, such as introducing bioeconomy to any school-level programme. Legal boundaries set the stage, organisational structures influence decisions, and community dynamics contribute to the overall challenges. Chapter 4 investigates specific barriers, and aims not only to pinpoint but also to lay the groundwork for possible strategies that will foster an environment that is open to the introduction of new educational content within schools.

Legal barriers

Legal frameworks play a pivotal role in shaping the trajectory of education in any country, as they provide the structure, the guidelines and the mandates that influence how curricula are designed, approved, and implemented. Understanding and working within these legal parameters is crucial for any educational initiative seeking to introduce interdisciplinary and emerging subjects like circular bioeconomy. The significance of legal barriers is underscored by their pervasive influence on multiple dimensions of the educational landscape. These barriers are tangible, codified rules and regulations that impact curriculum

development, teacher qualifications, assessment standards and overall institutional autonomy. Consequently, addressing legal challenges becomes imperative for fostering innovation, adaptability, and relevance within the educational framework.

Restrictions connected to national curriculum frameworks

National curriculum frameworks form the backbone of many educational systems, ensuring uniformity and consistency. However, their rigidity often becomes a significant challenge when attempting to introduce emerging fields like circular bioeconomy. These frameworks, designed for stability, inadvertently create barriers to the required interdisciplinary and innovative educational initiatives. In EU countries with established national curriculum frameworks, such as Belgium and Germany, the challenge lies in accommodating the dynamic and evolving nature of bioeconomy. While these standardised structures ensure educational consistency, they concurrently constrain the adaptability required for innovative fields. This challenge is particularly evident in Belgium, Estonia and the Netherlands, where accommodating new concepts within existing frameworks proves to be a formidable task. Furthermore, the centralised decision-making processes in countries such as Romania and Poland amplify the complexities associated with the seamless integration of interdisciplinary themes.

Compulsory subjects' constraints

The imposition of compulsory subjects within the curriculum narrows the space available for integrating new concepts. Nations like Hungary and Romania, operating within a stringent compulsory subject framework, afford minimal latitude for customisation. Poland confronts a similar challenge, as the syllabus must align with the core curriculum, limiting the incorporation of any innovative concepts. In Hungary, while schools possess the autonomy to introduce locally relevant content, aligning innovations with official curricula for securing funding involves an intricate balancing act. In Estonia and Portugal, where certain subjects are mandated, the struggle is apparent in finding room within the curriculum for comprehensive introduction of new content without sacrificing the depth required for understanding.

Centralised decision-making processes

Centralised decision-making processes, prevalent in many European nations, provide stability but often impede swift adaptations to emerging educational needs. Decisions related to curriculum changes, particularly at the national level, necessitate approval processes, introducing bureaucratic complexities and potential delays. Countries like Austria and Poland face challenges in introducing changes to the curriculum, as these alterations require rigorous approvals from central educational authorities. Similarly, the centralised decision-making processes adopted by Belgium, Germany, and Greece, hinder the integration of new topics into the educational programmes. In Romania the decision-making authority for curriculum changes is the Ministry of Education – contributing to elaborate, complicated procedures and potential bureaucratic impediments. Belgium, standing out in its linguistic diversity, confronts the additional challenge of catering to the distinct needs of multiple language communities.

Bureaucracy

The development of curriculum enhancements encounters bureaucratic hurdles, creating delays in the implementation of innovative ideas. Procedures, designed to maintain educational standards, inadvertently contribute to the slow pace in embracing emerging themes like circular bioeconomy. This is particularly

evident in the Netherlands, Greece and Romania, where the procedures in place designed to uphold educational standards are contributing to delays in the implementation of innovations. In Hungary, the decentralised nature allows schools to introduce local content – although securing funding for non-authorised programmes necessitates navigating additional bureaucratic challenges.

Limited autonomy of schools

While some autonomy is granted to schools, they often operate within the confines of a broader national framework. This limited autonomy restricts schools from tailoring the curriculum to meet the unique needs of their students and local contexts, hindering the potential for innovation. Regulatory constraints, manifested through adherence to national laws and regulations, significantly limit the autonomy of schools in tailoring the curriculum. This limitation is visible in Romania and Hungary, where compliance with the centralised framework is non-negotiable. In Hungary, the funding dynamics further complicate school autonomy, rendering official approval and financial support prerequisites for any contemplated curriculum changes. Schools in Wales grapple with finding the right balance between adhering to national curriculum frameworks and having the freedom to introduce locally relevant content.

Assessment and examination standardisation

The standardisation of assessments, while ensuring consistency, poses challenges in accommodating innovative evaluation methods aligned with circular bioeconomy competencies. Finding a balance between adhering to standard evaluation practices and incorporating novel assessment methods is essential. It becomes particularly crucial when considering the integration of innovative assessments that reflect competencies pertinent to the circular bioeconomy. The standardisation of assessments within a defined curriculum or of central final exams poses notable challenges in the Netherlands, Romania and Austria. In Greece and Ireland, where assessment standards are nationally regulated, there is a need to navigate the landscape carefully to introduce assessments reflective of circular bioeconomy competencies.

Teachers' qualification and training challenges

Educators face challenges associated with specialised training connected to new concepts, requiring a balanced approach to professional development that takes into consideration financial issues. Teacher-related challenges manifest in most countries, where educators encounter barriers associated with specialised training. The imperative to balance professional development with financial considerations becomes pivotal for educators. Moreover, the self-financing of additional teacher training presents challenges, and the limited teaching hours allocated for familiarising teachers with new materials further restricts the implementation of bioeconomy-related content. In Germany and Austria, teachers encounter challenges in accessing specialised training for bioeconomy education, raising questions about the preparedness of educators for this interdisciplinary field. There is an evident need for proactive initiatives led by school leaders in collaboration with their team in education in order to bridge the gap in the structure of training strategies. In this regard the Netherlands stands out as a model, with schools often charting comprehensive training programmes in advance, supplemented by dedicated training days provided by the institution.

Resource allocation and funding limitations

Limited financial resources pose challenges concerning resource allocation for innovative educational initiatives. Convincing stakeholders of the long-term benefits of circular bioeconomy education becomes a

critical aspect of overcoming these resource-related challenges. Budget constraints in the Netherlands, Poland, and Greece create challenges concerning limited financial resources. Allocating funds for innovative educational initiatives becomes a delicate balancing act, especially when conforming to existing salary scales. In Hungary and Romania, aligning funding priorities with the potential long-term benefits of bioeconomy education is essential, and requires concerted efforts to persuade stakeholders about the significance of this educational initiative.

Resistance to change and educational traditions

Institutional resistance to deviating from traditional educational practices poses challenges in many EU countries. In the Netherlands, Romania, and Ireland, striking a balance between tradition and innovation becomes pivotal in garnering support for bioeconomy education. In Hungary, overcoming institutional issues mandates a strategic and collaborative effort, given the systemic and transversal nature of bioeconomy approaches.

Navigating the legal and institutional landscape to integrate circular bioeconomy education into schools requires a nuanced understanding of the diverse challenges faced by Member States. Collaborative efforts, informed policy decisions, and a commitment to fostering adaptability and innovation in education are imperative.

Organisational barriers

Integrating bioeconomy curricula into schools faces multifaceted organisational barriers that can be broadly categorised into time-related challenges, infrastructure hurdles, limitations in educational materials, teacher capacities, financial constraints, and other organisational obstacles. This part of the chapter delves into these barriers, providing a comprehensive understanding across diverse educational landscapes in the EU Member States.

Time-related barriers

Time-related challenges encompass rigid timetables, heavy teacher workloads, and a lack of flexibility in scheduling. These barriers impede the incorporation of innovative curricula, limiting the scope for innovative teaching methods and outdoor learning opportunities. The struggle to balance academic demands with curriculum enrichment efforts underscores a need for more streamlined and time-efficient approaches.

In the majority of the countries, time-related challenges are prominent. Portugal, Ireland, Greece, Estonia, Austria, Belgium (Flanders), Romania, Hungary, Poland, Germany, and Wales face constraints within their educational timetables. The inflexibility of rigid schedules, limited time for extracurricular activities, and the burden of heavy workloads on teachers hinder the introduction of innovations. For instance, in Portugal the curriculum is dense, leaving little room for additional projects, while in Germany teachers' overburdened schedules and administrative tasks contribute to time-related barriers. On the other hand, students in the Netherlands often have a very high level of freedom in planning school-related activities.

Infrastructure challenges

Inadequate infrastructure embraces shortage of essential staff, insufficient facilities, and limitations in equipment. Schools grapple with varying degrees of resources, impacting the implementation of bioeconomy

curricula. Addressing these challenges necessitates strategic resource allocation, facility improvements, and an understanding of the unique infrastructure constraints in different regions.

Member States face many infrastructure challenges. Inadequate facilities, lack of outdoor learning spaces, and disparities in resource distribution pose obstacles. For example, the scarcity of funds in Greece limits access to equipment and impedes the development of suitable learning environments. Similarly, Estonia faces financial constraints affecting the availability of resources for outdoor activities.

Barriers related to educational materials

Access to quality educational materials poses a pervasive challenge, with issues ranging from outdated resources and language barriers to financial constraints. This underscores the importance of comprehensive resource repositories, adaptation to local contexts, and strategies for overcoming linguistic limitations in curriculum implementation.

Common challenges across the EU include a lack of access to suitable materials, linguistic barriers, and the need for localised resources. A significant barrier in Hungary for instance is the lack of motivation among teachers to incorporate new materials, coupled with limited access to resources in English, which is not widely spoken among teachers. Estonia confronts outdated materials predominantly in English, necessitating adaptation to the local context. Austria highlights limited access to quality resources, demanding a revamping of material procurement strategies. Belgium (Flanders) encounters linguistic barriers and a dearth of materials in the local language, affecting effective teaching. Hungary's financial constraints impact the availability of resources, particularly in bioeconomy. Poland faces limited access to necessary educational materials, emphasising the need for comprehensive resource repositories.

Challenges in teacher capacities

Teacher-related barriers encompass motivation gaps, resistance to change, and deficiencies in skills and competencies. Overcoming these challenges requires targeted training programmes, motivation-building strategies, and a shift toward a more adaptive and innovative teaching culture.

In many EU countries, the burden of heavy workloads on teachers can hinder the seamless integration of bioeconomy curricula. For instance, in Portugal the curriculum is dense, leaving little room for additional projects, while in Germany the teachers' overburdened schedules and administrative tasks contribute to time-related barriers. In Romania, the focus on traditional teaching methods and the resistance to deviate from established practices hinder the incorporation of innovative education.

Financial constraints

Financial barriers are emerging as a substantial impediment, impacting resource procurement, extracurricular programmes, and overall curriculum development. Successfully navigating these financial challenges demands strategic budgeting, seeking external funding avenues, and fostering collaborative financial planning.

Estonia is grappling with the unequal distribution of financial resources among local governments, impacting innovative learning scenarios. Belgium (Flanders) is facing financial constraints, especially in public schools, limiting extracurricular programs. Hungary is contending with a lack of funding and a disconnect between municipalities and schools. In Poland, budget constraints in public schools might be affecting prioritisation of bioeconomy education. And Germany is noting financial constraints hindering material purchases and the

funding of excursions. Addressing these financial challenges requires strategic budgeting, seeking external funding avenues, and fostering collaborative financial planning.

Other organisational barriers

Beyond primary categories, additional organisational challenges include cultural resistance to change, bureaucratic processes, and the absence of external financial support. Overcoming these obstacles requires a concerted effort to foster adaptability, streamline bureaucratic processes, and explore diverse funding sources.

Estonia's absence of mandatory outdoor learning contributes to a lack of teacher motivation. Belgium (Flanders) notes an organisational culture resistant to change, demanding a shift in mindset. Hungary cites language and fundraising limitations as impacting participation in EU-funded projects. Poland underscores the impact of school heads' approach, bureaucratic processes, and the absence of external financial support. Germany emphasises an ingrained organisational culture resistant to change, requiring a concerted effort to promote a more adaptive ethos.

Understanding the nuances of these organisational obstacles provides a foundation for tailored strategies in bioeconomy curriculum integration. Policymakers, educators, and stakeholders can draw insights from these challenges to craft context-specific approaches. Successfully navigating these complexities demands multifaceted solutions, ranging from targeted teacher training to strategic financial planning and a cultural shift toward adaptability.

Socio-cultural barriers

Introducing bioeconomy curricula in schools across the EU is encountering significant socio-economic barriers, reflecting diverse challenges in fostering awareness, understanding, and adaptation to this innovative field of study. Long-standing traditions and habits in particular might resist the integration of such content into teaching programmes. However, this resistance is found not only among teachers, but extends to schools being viewed as the sole legitimate source of knowledge. In certain countries, political beliefs further complicate matters, with climate and environmental issues becoming politically charged topics. This leads to a direct transfer of controversy from politics to education.

Limited awareness and lack of acknowledgment

A prevailing barrier is the limited awareness and understanding of bioeconomy among students, parents, and educators. Lack of limited understanding of concepts such as bioeconomy, outdoor learning, and communities of practice can impede the adoption of any innovative approach. The unfamiliar terminology associated with bioeconomy is contributing to a lack of comprehension, necessitating efforts to simplify concepts without jargon. This lack of familiarity can extend to teachers who may lack the necessary training to effectively address bioeconomic concepts in their teaching. What is important to mention here is that outdoor learning is sometimes viewed as an indulgence rather than a legitimate form of education.

Students' understanding and acknowledgment of the relevance of bioeconomy content to their daily lives is also a very important factor when it comes to a successful introduction to teaching. This lack of perceived relevance can diminish students' motivation to engage with bioeconomy-related subjects. Furthermore, difficulties in demonstrating the practical application of bioeconomic knowledge in everyday situations

constitute a considerable obstacle. This challenge is particularly pronounced among younger learners, where the abstract nature of bioeconomy concepts may hinder their applicability to real-world scenarios. The redundancy of content within existing curricula also presents a significant hurdle. In some instances, new bioeconomy-related content may overlap with existing material, such as that covered in science or biology classes. This redundancy can lead to a reduction in student motivation to engage with the subject matter, as the perceived value of revisiting similar concepts diminishes. For example, the issues of fragmented sustainable development education were highlighted in the Netherlands and Flanders; they make it challenging for students to see the connections between different aspects of the topic. Likewise in Portugal, the appearance of apparent challenges in demonstrating the relevance and application of bioeconomy concepts to students' daily lives may potentially lead to disinterest.

Greece faces a lack of cooperation culture among teaching staff, impeding successful cross-curricular approaches. In Poland, entrenched beliefs about education and controversies tied to political beliefs cause limited awareness and resistance to change. This is particularly apparent where climate and environmental issues are concerned. As highlighted in the case of Romania, a long-term transition is required for bioeconomy integration. Challenges in social awareness and communication, and the relative scarcity of knowledge about the circular bioeconomy, underscore the complexity of this task.

Climate anxiety

Environmental issues present a distinctive set of challenges. Incorporating new content into curricula, touching on topics connected to climate change and environmental sustainability, may inadvertently be restricted by concerns about unintended psychological consequences among students, such as climate anxiety or climate grief. Awareness of bioeconomy is often overshadowed by more immediate concerns, and the introduction of these concepts may lead to further exacerbation of this problem (as some countries face superficial awareness of environmental problems, with a focus limited to selective waste collection). Climate anxiety, in this case, can be not only a significant barrier, but also a possible effect of new topics present in the curriculum.

Hungary faces challenges in environmental awareness and knowledge about bioeconomy among teachers. The psychological impact on students, particularly concerning climate change, necessitates careful preparation and training. Many countries are experiencing challenges related to a lack of environmental awareness among not only students, but also parents and teachers, potentially contributed to by climate change fatigue. The case of Austria revealed a lack of sensitivity to sustainability-related topics among some teachers and students, highlighting the impact of media competence in processing information from various sources.

Cultural norms and values

Cultural norms and values can act as barriers, especially when innovative forms of learning are perceived as conflicting with traditional teaching methods or cultural values. In Poland, the introduction of extensive extracurricular activities or innovative teaching methods may face resentment from other teaching staff members, creating a resistance to change. While some countries such as Estonia demonstrate openness to new forms of learning, the age of teachers could pose a minor barrier, as older teachers may be less inclined to try innovative approaches. In Portugal, the education system's resistance to change and scepticism toward interdisciplinary approaches hinder the introduction of innovative methods in bioeconomy education.

Moreover, the socio-economic capacities of families play a role in the feasibility of excursions and outdoor activities, as indicated in Austria. In Greece, there is resistance to anything that cannot be quantitatively assessed, such as skills, reflecting a conservative approach to educational innovation. Portugal emphasises socio-cultural barriers leading to disparities in access to educational opportunities. Certain groups or communities may face limited access to resources and technology, perpetuating educational inequalities in bioeconomy learning.

5. Societal involvement in setting bioeconomy policy and engagement focusing on curricula innovations

Education is widely recognised as having a strong correlation with multiple forms of civic and social engagement; however, understanding this relationship recognises its multiple dimensions and channels that it can be mainstreamed through. Societal participation in decision making can take different forms, including provision of information, consultation, dialogue and active involvement (Council of Europe, 2017). The section below reflects on citizen participation in education and policymaking, and ways that civic engagement can go further to influence governance structures.

Citizen participation in education about the environment and bioeconomy

Civil society is essential for promoting inclusive, responsive, and quality education systems that meet the needs of all members of society. By working collaboratively with all stakeholders, educational institutions can ensure that the curriculum reflects diverse perspectives, addresses societal challenges, and empowers individuals to become active and engaged citizens. The engagement of various stakeholders in society should be adopted as a common practice, as it builds awareness and knowledge on the local challenges, fosters interdisciplinary collaboration, and promotes lifelong learning with the engagement of students, encouraging them to continue their involvement in bioeconomy governance beyond their formal education.

Rethinking positivist education

Education overall is heavily embedded in a positivist education model, which centres teachers as convenors of knowledge, and the learning is more focused on 'factual' and 'logical' science, experiments, and statistics. Instead, non-positivist education is embedded in the idea of socially constructed knowledge, with multiple 'truths' and interpretations, and all social actors (including children) treated as important. Two of the common non-positivist approaches to learning about environmental sustainability are Education for Sustainable Development (ESD) and Global Citizenship Education (GCE) (Khoo & Jørgensen, 2021). Both of these promote decolonising education to go against neoliberal, positivist science, focusing instead on more critical, participatory, ethical and situated research. This includes focusing on transgressive and transformative education, and moving towards more collective, participatory, and action-oriented learning. ESD and GCE require solidarity and justice instead of Western paternalism or charity towards the 'less privileged'. Another common ground is 'border thinking', furthering diversity and intercultural perspectives by engaging with marginalised, stigmatised, and excluded communities and movements. These approaches also creatively reinvent the individualist and 'neoliberal' education for alternative, cooperative, and supportive science, research, and teaching. Many of the bioeconomy education initiatives fit perfectly into these alternative

approaches, with creative and participatory components to meaningfully engage all stakeholders in creating a sustainable future. Likewise, curriculum development can also reinforce more non-traditional educational models in the new curricula.

It is also important to mention that Open Schooling (an approach that encourages schools to collaborate with a wide range of local actors for providing the education that is right for their student population) and the whole school approach (that acknowledges and actively builds on the fact that children are educated not only by teachers of a school but by a wide range of actors – such as the non-teaching staff of schools, parents, other family members, and representatives of external actors a school works with) are at all times two concepts that are primarily the same, but the view they take on education is a little different. Both have been high on the European education agenda for years as more or less synonymous. Thus, when we speak about one, we also speak about the other. Both incentivise schools to acknowledge the plethora of educators and venues for learning in the life of a child, and both also focus on the joint responsibility for the education of today's children.

The Berlin Declaration on Education for Sustainable Development; Learn for our planet: act for sustainability (UNESCO 2022) was the result of the UNESCO World Conference on Education for Sustainable Development in 2021. By joining the Declaration, participating countries underlined the urgent need for action and pledged their commitment to implement Education for Sustainable Development. The Declaration identifies education for sustainable development (ESD) as a whole community responsibility, and explicitly asks for the different actors to collaborate on the necessary educational actions. While governments have pledged to include ESD in their school curricula, they also agreed to promoting "a whole institution approach, recognizing that learners and the school community become meaningfully engaged in sustainable development through democratic participation when their institutions become living laboratories for […] sustainable consumption, and where learning is experiential, action-oriented, localized and culturally specific, allowing learners to learn what they live and live what they learn".

Environmental education models and initiatives also depend heavily on the assumed perspective on the learning process (Reid & Nikel, 2008). These include behavioural, cognitive, and situative perspectives. Behavioural learning prioritises changes in behaviour and attitude by acquiring a set of associations and skills. The cognitive perspective emphasises the learner's agency as part of an active, constructive, and goal-oriented process common in the developmental field. Situative perspective shifts the focus from the individual to communal and relational learning, building communities of practice. Depending on which perspective is used, participation models differ. The role of actors, the degree of participants' freedom, recruitment, participation structure, scope and justification all contribute to the participants' final conduct. The best effects with regard to bioeconomy education, however, seem to be linked to situative learning, when communities are assembled for practice but wider community structures also benefit.

Community-based learning

A distinct form of participation in education development is community-based learning, a strategy when students' civic responsibility and citizenship skills are conveyed and nurtured, along with service for the community (Boland, 2010). There are two community-based learning models: one is transactional, where community service is exchanged for academic credit, and another is transformative, which focuses on academic, civic, and societal outcomes. Civic orientation can be local and broad, focusing on the student and

their learning development and personal values, or can be pragmatic, for higher education value. Introducing community-based learning principles in the curriculum can be helpful, especially ones focused on civic transformation.

Civic-oriented curriculum planning, if organised in an organic, incremental and bottom-up way, can be a collaborative effort that supports community-based learning (Boland, 2010). The collaboration must be internal (created as a group), but should also have external relations with the community – building connections with student-led projects and partnerships with community members. More collaborative and partnership-based learning is also more complex, and builds better capacity for reciprocity, but it can also have more challenges. These benefits and challenges require careful attention prior to and in the process of curriculum making.

Community engagement in the promotion of sustainable practices in educational settings requires the following principles: being guided by locally identified needs and organisational strengths; the empowerment of all parties; stakeholders' role modelling and forming close connections; communication through collaborative learning; and measurement and feedback (Blythe et al., 2018). This multi-stakeholder effort is one of the factors that support civic engagement.

Identifying the key stakeholders is a crucial process in participatory curriculum development (Alexander & Hjortsø, 2019). Stakeholder analysis works best if it reconstructs not only the actors (subjects) involved, but also the objects, tools, rules, outcomes, division of labour, and the community, thereby identifying tensions, interests, resources and power relations. When knowing which stakeholders can be involved, mobilising partnerships and sharing responsibilities can be better facilitated to ensure effective participation and, in consequence, collaborative curriculum making.

Another neglected aspect of community-based learning is the role of personal values and emotions. Education for sustainability tends to omit personal experiences, which can be a part of curriculum development (Wamsler, 2020). Creating education that one can connect to and align with its values, along with applying reflexivity, mindfulness and empathy, contributes to creating an 'inner transformation' for meaningful sustainability. This is the case for youth-led activism in regard to their environmental education, where young people engage in matters that they personally find important.

Youth-led activism

Many youth-led social movements have clear policy pledges and initiatives, as well as non-violent direct action (Sloam et al., 2022). In some cases, political representatives or world leaders engage with them, yet there is still a lack of direct input by youth in policymaking. Although participation in curriculum development has a place for young people, their voices are not always heard and harnessed in the most effective way. Instead, young people can be tokenised for the illusion of participation, while their opinions do not really count. It is because of this lack of agency that youth-led initiatives are so popular among young people today.

Youth-led activism can be realised through voting, lifestyle choices, community and protest actions, and collective do-it-ourselves politics – in general, by being 'active' (Pickard, 2022). Many of the younger generation report that taking action for the environment is essential in their lives. Contemporary young people growing up in the global crises (economic, political, environmental, health) and surrounded by institutional inefficiency means they are disappointed with the traditional politics and political parties. In certain parts of

the world, young people receive an education that teaches civic engagement and environmentalist positions. This is encompassed by global digital connectivity, as knowledge and opinions circulate and enable activism. There have also been certain value shifts resulting in young people becoming more socially liberal, postmaterialist, and more concerned about injustice than previous generations. Although they know low-level activism will not solve environmental issues, not being passive aligns with their personal values. This 'new generation politics' is more participatory and collaborative, and draws attention in a peaceful and kind way.

One of the concepts associated with youth-led activism is 'action competence', where young people function in a society in an action-oriented way, involved in practical and collaborative work, with hope and optimism for a better environmental and socio-ecological future (Henderson & Tudball, 2016). Some of the civic engagement initiatives that young people can mobilise in the school environment are: self-formed small action groups linked with the local community; school-based environmental campaigns, such as rubbish collecting competitions; community sustainability events at schools; self-organised online campaigning; youth-led summits and presentations at other schools; open letters, protest actions and marching; and, of course, redesigning the curriculum. Many such examples have been seen in bioeconomy advocacy both for implementing in daily life and for introducing into education.

Social innovation and empowerment

Formal education is often resistant to change and innovation, and therefore some of the creative forms of teaching and learning are suppressed (Schröder & Krüger, 2019). Innovation strategies can be grounded in the potential of co-creation tools and strategies or politically established policies supporting innovation. Whereas social innovation action is taken within the system (by ministries, schools, and universities), institutional governance limits innovation. There is a disintegration between stakeholders and all societal sectors (science, public, economic, and civil society), meaning that a holistic approach is lacking. If social innovation were better accepted overall, many of the potential initiatives could be extrapolated or of better quality. Bioeconomy educational practices often use creative forms not only to engage students but also to disrupt existing inefficient systems. Because of this innovation, complex educational content can reach young people in a more direct, interesting way. Social innovation in education can also contribute to empowerment.

Individuals who want to intervene in education in sustainable development and environmentalism must be aware of and be able to estimate their impacts, namely, they must have the democratic literacy to understand democracy as a social system full of plurality, solidarity, publicness, and civil society. Sustainability requires informed and empowered citizens who can be both aware of economic, ecological, and societal conflicts and of their agency. This can be done by acquiring skills to enable empowered citizens to use them in a responsible way to strengthen democracy (Ohlmeier, 2013). With growing efforts from countries and structures like the EU to teach young people civic engagement from the beginning, bioeconomy is a domain that corresponds well with democratic values and citizen empowerment. Bioeconomy education should be inherently linked with civic education.

The next section will describe citizen's engagement in governance structures for the environment and what factors contribute to successful participation.

Citizen engagement in environmental governance structures: models and factors

Citizen engagement in governance structures is dependent on the social, cultural, and political contexts. While some regions in Europe are way ahead in involving citizens in decision-making, in others, participatory principles remain limited. These contexts are surrounded by different participation models, needs, and structures, and factors enabling or restricting citizen engagement. In policymaking for bioeconomy education, these contexts and forces cannot be underestimated, and the situatedness of curriculum development should rely heavily on the reality they are embedded in.

Participation and community models

The forms of participation do not have to determine success or its outcomes, as there are many factors, internal and external, that can impact effective public participation (Chess & Purcell, 1999). Public participation needs clear goals, advanced planning, modification and fluidity, a combination of various forms of participation, and iteratively learning from feedback. Some of the early public participation measures in environmentally related policymaking or projects took place through public meetings, workshops, and community advisory committees. Today, many of these efforts remain popular among activists, and some new forms of resistance have emerged.

Contemporary models of participation in sustainable efforts can include invited, deliberate and professionally facilitated structures, uninvited and horizontal autonomous activists, technologically-driven corporates aiming at consumers, and grassroots citizen-led communities (Chilvers & Longhurst, 2016). A key commonality of participatory models is opening engagement in sustainability to actors from civil society. A central role is also played by technology, which now mediates, organises and configures relationships in activist collectives. Collectives lack insights about framing effects, their construction of publics, and models of participation, which can inform reflexive governance that guides systemic changes. In previous diagnoses of actors in bioeconomy curriculum development, some of the most successful participations have included the formation of collectives, with representatives of different stakeholders, to co-create and discuss curriculum innovation.

Public engagement in the bioeconomy transition is achieved through various forces related to engaged actors, including enrolment, mediation among the group, and certain exclusions (Lynch et al., 2020). The public requires careful framing; if we are engaging 'members of the general public', they still have individual identities that transpire through the participation process. In bioeconomy, they may also refer to it due to different roles: common society capable of appreciating and discussing the value of bioeconomy for society; consumers of bioeconomic products; indirect consumers (e.g. of biofuels); the affected public (e.g. neighbouring bio-refineries); or partisan public (organised advocacy, e.g. as an NGO). Participants must be recognised as empowered and feel that their input matters. Participation, even if successful, is still susceptible to contextual forces that can impact its implementation.

Factors in participation in governance structures

Incorporating non-formal education into participatory curriculum development can harness creative forces and foster social innovation through participants' know-how. Community learning centres and initiatives can be a pathway for sustainability education, especially when delivered in a multi-stakeholder network including schools, non-NGOs, national, municipal and local governments, businesses and researchers, and following governmental priorities (Noguchi & Sasaki, 2016). Some cater to specific marginalised communities, such as youth-at-risk or poverty-ridden rural citizens (Singer & Nagata, 2016). This is especially important for civic engagement, which is sensitive to marginalisation and, by principle, is inclusive and equal.

Political context impacts civil society engagement in curriculum development, especially in regard to freedom of expression, association and assembly, through sophisticated mechanisms such as restrictions of foreign funding, anti-terrorism laws, and government control over CSOs (Claessen & De Lange, 2016). More effective forms of policy influencing in such conditions include working closely with local authorities, advising and lobbying, being involved in service delivery, and sectoral work. Cooperation with other civil society actors, for example other CSOs, helps in creating sustainable civil societies. Bioeconomy education and civic engagement is supported by the EU agenda, but local political circumstances may not be so favourable. Therefore, dialogue with politicians and institutions is key to successful collaboration for curriculum development.

CSOs, for example, as representatives of donors and recipients of services, can be participants in NGOs or international organisations and have an impact on policymaking mitigated through wider, more formalised structures with better lobbying power (Kalinowski, 2020). This means that laypeople can have a bigger impact when cooperating with other bodies, as fully grassroots initiatives can sometimes remain invisible to higher players. Again, when considering far-reaching systemic change, cooperation with wider structures such as NGOs or international organisations that have more power can be more impactful for bioeconomy curriculum development.

Still, curriculum innovation often stems from grassroots movements. Bottom-up solutions in modern environmentalism and sustainability development have been implemented in many places in the world, rural and urban, by activists, development workers, community groups and neighbours (Smith & Ely, 2015). Some of these grassroots innovations develop into widespread practices, and some stay the same and impact local communities. Grassroots efforts in green transformations may have two political dynamics: inserting grassroots innovations into conventional institutions, or mobilising around grassroots innovation as a form of resistance. However, policy and business tend to be inconsiderate of these efforts, as their initiatives are not picked up, and some discourage grassroots creativity as threatening to their agenda. A more welcomed role of the public is a consultancy model or the participatory development of centrally-orchestrated efforts, which can disempower communities or empower them only partially. Importantly, grassroots-based curriculum innovations require institutional support, and it is best if favourably received and implemented into bigger policies instead of being shut down and silenced, which only produces potential resistance and conflict on the line between community and authority.

From governance engagement in education, to civic engagement in adult life

Engagement in governance at the level of education can have a significant impact on each of the groups of actors we discuss, but special attention should be paid to students, for whom school is a training ground for later functioning in society. Engaging young people at this stage, and giving them a sense of agency, translates into their civic engagement in adult life beyond the educational context. This is because in the early years of our lives, the foundations of identity, morality and citizenship are shaped in each of us (see Núñez & Flanagan 2015). Early involvement in governance promotes and strengthens such values as democracy, cooperation and tolerance; moreover, it encourages students to maintain and defend these values in adult life (Flanagan & Levine 2010).

Some of the benefits of such involvement are linked to academic achievement. Although the association may be indirect, research suggests that engaged students are happier and feel more in control of their learning,

while participation enhances skills of communication and therefore their competence as learners (Davies, Williams & Yamashita 2006).

Another benefit, related to the previous one, is greater self-esteem and confidence. This results from taking responsibility and having a sense of ownership of various aspects of school life. Increased confidence has been especially noticeable for school councillors and others taking a public role. It has also been evident among those with special needs, gaining a stronger sense of self-belief and engagement in learning (Davies, Williams & Yamashita 2006).

Participation at the school level also teaches skills that are transferable to other spheres of life, such as work, family or politics: the skills of communication, cooperation, critical thinking and problem solving. These activities can also shape such civic habits as participation, awareness and advocacy, and foster a sense of agency and effectiveness among students. These habits are important for civic engagement because they reflect the frequency, intensity and quality of individuals' involvement in civic matters (Flanagan & Levine 2010; Ballard, Hoyt & Pachucki 2019). This in turn affects their health, education and income in adult life (Ballard, Hoyt & Pachucki 2019).

Moreover, participation in school and outside functions as an apprenticeship in democracy, where skills of speaking, listening to the views of others, advocacy, argument, negotiation, compromise, and teamwork can be practised (Davies, Williams & Yamashita 2006). These skills are essential for active and responsible citizenship, which contributes to the development of a democratic society.

6. Recommendations: the path towards a common structure of innovative governance

Social participation in education

A description and analysis of the various actors involved in the process of introducing new content to schools is presented in Chapter 2 of the report. In this section, we attempt to propose a model approach to social participation in education. We examine participation at three levels: political, school, and social environment. Each of these levels is significant in the context of innovative governance structure that could enable introduction of new content into schools.

At the political level, the involvement of non-political experts in the process of creating curriculum and similar processes is one of the key aspects of social participation in education. Their role should be systemically and institutionally recognised, not ad hoc. Moreover, it is crucial that experts be selected with care, based on their profiles, qualifications and experience. Ideally, the experts should have both theoretical and practical knowledge of education and be familiar with the realities of both higher and general education. The role of political actors, on the other hand, should be limited to setting the general directions and framework of the curriculum, without interfering with the details and specifics. This would prevent the risk of micro-management and manual control, which often leads to excessive ideologization and politicisation of the education system.

Another key aspect of social participation in education is the involvement of teachers, parents, and students in school management. This participatory model has many advantages, such as:

- It allows each of the three most important groups in the school to present their arguments and perspectives on the school's goals, policies, and practices.
- It fosters a constructive dialogue and collaboration among the different stakeholders, leading to better outcomes and solutions for the school community.
- It enhances the sense of responsibility and ownership of the school and its environment among the participants, as they are actively involved in shaping and improving it.
- It builds a sense of agency and empowerment, especially among young people (but teachers and parents as well), who can develop their skills, confidence, and civic engagement through participation.
- It promotes diversity and inclusion, as it respects and values the opinions and needs of different groups and encourages them to contribute to the school's development.
- It creates a positive and supportive school culture, as it fosters trust, respect, and cooperation among the school members, and reduces conflicts and tensions.

To ensure the effectiveness and sustainability of this model, it is essential to have a clear and transparent framework for participation, as well as adequate support and resources. The supervisory bodies (such as curators) should be depoliticised and de-ideologized, and focus on providing quality assurance and guidance rather than interfering and imposing control.

It is also very important to strengthen the voice of individual groups through their self-organisation and networking. For example, schools can form associations to cooperate, exchange good practices, and organise inter-school events and activities. Teachers can join trade unions to advocate for their rights and interests, and to access professional development opportunities. Parents can create associations to support the school and their children and participate in decision-making processes. Students can go beyond participation in school, and engage in wider civic and social initiatives, such as student parliaments, volunteer work, or activism. By doing so, each group can enhance its position and influence, and contribute to the improvement of the education system. Additional training and support frameworks should be offered within those bodies – especially student and parent bodies.

The third key aspect of social participation in education is cooperation between schools and their social environment, which includes local communities, non-formal education providers, NGOs and businesses. This cooperation can bring many benefits to the school and its stakeholders, such as:

- It can enrich the educational offer by providing diverse and innovative learning experiences, resources, and methods.
- It can foster social inclusion by exposing students to different cultures, values, and perspectives, and by addressing the needs and interests of various groups.
- It can create opportunities for learning and development by enhancing the skills, knowledge, and competencies of students, teachers, and other participants, and by facilitating their transition to further education or employment.

An approach emphasising the role of participation is, among others, open schooling – an approach to education that is 'open' in terms of timing, location, teaching roles, instructional methods, modes of access, and other factors related to learning processes. It includes a component of collaboration between schools and local communities. Students and teachers invite parents and their communities to jointly develop research

and innovative projects that address significant local challenges and contribute to community development. Through this, schools become key community actors, and students perceive themselves as change-makers.

It is important to note that to ensure the quality and sustainability of this cooperation, it is essential to have a clear and transparent framework for participation, as well as adequate support and resources. It is also important to respect the autonomy and voice of each group involved in participatory school governance (teachers-parents-students) in admitting non-formal educators and businesses to the school, while limiting the interference of politicians in this area. The cooperation between schools and other social partners should be based on the principles of equality, non-discrimination and non-ideologization, and should aim to achieve common educational goals and values. The activities of businesses in schools should be subject to careful reflection and evaluation to avoid monetising students and their activities, to ensure equal access to education and materials, and to respect the principles of fair competition. The participation of religious actors in schools depends on the cultural and political context, and we do not propose a specific model in this respect. Regardless of the existing framework, educational freedom must be upheld, and personal freedom and the ability for students to express themselves should be respected.

We would like to conclude by highlighting the special role of collaborative bodies that bring together many actors from all three levels of participation: political, school (including teachers, parents, and students), and the social environment. These bodies can facilitate the cooperation and coordination of different stakeholders and ensure that their interests and needs are represented and addressed. In these bodies, it is especially important to ensure that:

- All actors have equal positions and power, and that no one is marginalised or excluded.
- All actors have freedom of expression and can raise issues that are relevant and important to them, without fear of censorship or retaliation.
- All actors have real competencies and resources that enable them to manage and improve the education system, and are not only advisory bodies whose voice can be easily ignored or overruled.

By ensuring these conditions, the collaborative bodies can enhance the quality and sustainability of social participation in education. This way we can create a more democratic, inclusive education system that fosters the introduction of new content into schools as it allows adapting the content to the needs and expectations of different stakeholders and ensures their involvement and acceptance.

Procedures for introducing new content into schools – model approach and recommendations

Chapter 3 of this report describes the various procedures for introducing new and innovative content and approaches into schools. Here, on the one hand, we summarise those considerations in the context of the other topics covered in the report, while on the other we formulate recommendations for educational policies at different levels. Procedures operating in very different educational systems are evaluated in this respect, so it is important to bear in mind that the aim of this section is to point out desirable features that may have the right effect or the absence of which may be damaging, rather than to suggest transplants of particular solutions from one country to another.

Three types of procedure have been identified, depending on who is responsible for initiating and conducting them: procedures linked to individual teachers; procedures linked to schools and their school heads; and procedures linked to authorities at the local or central level.

The very existence of three different types of pathway through which new content can be introduced into schools can be seen as positive. A plurality of possibilities is advisable, and every education system should include all three. In this way, the most appropriate pathway can be chosen depending on the circumstances of the respective content being introduced into schools, its nature, and the needs of the particular class, school or community.

With this in mind, however, it is possible to identify certain features of approaches that can be evaluated positively, as well as nodal problems that require further reflection.

Funding

An analysis of practices in different countries indicates that at least some degree of decentralisation in deciding on the content taught in schools is desirable. While some minimum structuring of the curriculum is necessary to ensure that every pupil has the opportunity to acquire equivalent knowledge and skills, it is also important for schools to be able to respond flexibly to the needs of pupils, the local community and the changing world.

As far as the procedures for introducing new content into schools are concerned, the need to obtain approval outside the school – with authorities at local and central level – should be reduced as much as possible in favour of far-reaching school autonomy. The primary justification for the need to secure external approval for school activities is the need for additional funding. But even this can be solved by the systemic provision of resources dedicated to introducing new, innovative content into schools within their discretion.

In order for it to be effective, it is extremely important that the procedure includes opportunities for funding or at least organisational support. Providing funding or organisational support for new content in schools can help to increase equity in education. Schools in low-income areas may not have the resources to provide their students with the same opportunities as schools in more affluent areas. By providing funding or organisational support, schools in low-income areas can use the same procedures as any other schools, which can help level the playing field. Without funding or organisational support, many schools may simply not have the financial resources to introduce new content.

Moreover, on the whole the introduction of new content into schools should not be a one-off event. It requires ongoing support and resources to ensure that the content is sustainable and effective. By providing funding or organisational support, schools can ensure that new content is sustainable and that students continue to benefit from it over time.

Teachers

Regardless of the support that is offered, the introduction of new and innovative content into schools will always put a strain on the teacher in some way, and will require them to be more involved than usual.

It should therefore be noted at this point that for a teacher to be willing to make such a commitment, it is essential that they have the right working conditions. They must be a teacher who receives decent wages, so that these wages also motivate them to work beyond their basic duties. The working day of such a teacher must not be overloaded with lessons and tasks, so that there is space to pursue things outside the curriculum.

Ideally, they should work in one school and not in several, so that their day is not filled with commuting and so that they can form a bond with the school and the pupils, which also acts as a motivator. Finally, they also need to receive adequate training and feel the support of other teachers, parents, the school head and the authorities, which would encourage them to initiate and participate in procedures for the introduction of new content into schools, including procedures that require stepping outside the school and the teacher's discretionary authority.

Organisational forms

It is very important that the procedure for introducing new content into schools allows for adjustment not only in the content itself, but also in the form in which that content is delivered – both in terms of teaching and organisation. Different content requires different forms, meaning forms that have the greatest potential for conveying it.

For this reason, procedures should allow for outdoor lessons and not just in the classroom, lessons that are longer or shorter than standard classes, and block courses taught in less than a whole school year. They should make it possible both to combine different subjects, to mix year groups, and to allocate only part of the pupils to participate in such a project.

Many of the procedures analysed allow for such changes – especially those for which the approval of an authority above the school is necessary (exceptions include pedagogical innovation in Poland).

Depoliticisation

Although education is by its very nature a thoroughly political sphere, it is important that the procedures for introducing new content into schools – or for determining what should be taught at all – are as far as possible free from direct political pressure. In many countries, teachers and experts signalled that the composition of the central curriculum is determined according to current political needs. Moreover, certain topics – or at least a certain interpretation of them – are proving to be politically uncomfortable, which significantly hinders their introduction into schools.

Both the preparation of the curriculum at the central or local level, and the supervision and control of the procedures enabling the introduction of new content into specific schools, should be carried out by independent experts. NGOs and informal educators should have access to the school and the possibility to offer their services to pupils, which can only be limited by the best interests of the children and not by political decisions.

Inclusion

Inclusivity is another desirable feature of procedures introducing new content into schools. While on the one hand there needs to be clarity regarding who can initiate them (so as not to create confusion), on the other they should involve as wide a catalogue of actors as possible (see Chapter 2). The main benefits to be gained from involving more actors are the legitimacy and effectiveness of the changes implemented.

When more actors participate in the process, there is a growing sense among them that they share responsibility for the planned changes. In a collaborative process, the shape of the content and forms to be introduced into the school can be refined in dialogue between the actors. In this way, different perspectives and interests can be taken into account. What's more, the extra work inevitably involved in introducing

something new to schools is shared among more people. The actor initiating the procedure does not feel like a lonely island, but rather part of a supportive school community. All this reinforces the legitimacy of the changes being made.

Wider legitimacy translates into increased effectiveness of the solutions introduced. Even if individual actors are not involved in the process of introducing new content into schools, they will still ultimately be affected. They may then perceive it as being imposed on them by someone else and may resist because of this. Meanwhile, if they are involved from the very beginning, resistance to collaborative solutions is usually much lower and the willingness to cooperate is greater. In this way, the effectiveness of new changes is increased and the cost of implementing them is lower (because it does not include overcoming resistance from other actors).

Unfortunately, among the procedures analysed for this report, it is difficult to find any that involve teachers, students, parents and also the local community – business, the third sector, etc. – in a far-reaching and systemic way. This most often involves leaving a role to existing structures involving individual actors (see Chapter 2), which may be dysfunctional. Developing more inclusive procedures is essential for a more innovative governance that provides the possibility of effectively introducing new content in schools.

Overcoming barriers

Introducing new content to the curriculum should begin with identifying and understanding the specific barriers: legal, organisational, and also socio-cultural. This may involve a comprehensive investigation of the country's situation, as well as holding discussions with a variety of stakeholders (including not only teachers and staff of the educational organisation, but all of the actors who are – directly or indirectly – participating in the education process) to gather feedback to gain a comprehensive understanding of the challenges faced.

Overcoming legal barriers requires a holistic approach based on multi-stakeholder commitment, embracing national and regional policymakers, educators and community members, that would prioritise the fostering of adaptability and innovation in education, allowing for the integration of new concepts into curricula. Educational institutions should actively engage with policy-making stakeholders to not only advocate for supportive legal frameworks, but also to raise awareness about the importance of educational innovations and corresponding profits – not only to learners, but to society as a whole. Creating partnerships based on public-private efforts, as well as a wider social dialogue that addresses the needs of educational institutions and requires adaptability in policies and framework, is crucial.

Navigating organisational barriers corresponds to addressing the challenges of intra-institutional stakeholders. Collaboration, strategic planning and above all the commitment of all those engaged in the design and implementation of curricula in schools should focus on crafting context-specific strategies, tailored to the institution.

Effectively addressing the socio-cultural barriers, a targeted approach that is based on a comprehensive understanding of the root of such barriers is also of key importance. Awareness raising among students, parents and educators, and in general among people connected to the functioning of the institution, responding to their concerns and misconceptions while highlighting the importance of interdisciplinary and innovative approaches, can greatly contribute to overcoming resistance.

BioBeo curriculum

As part of the BioBeo project, educational materials have been developed for bioeconomy education. While designing these materials, we carefully considered recommendations from the associated report. Our goal was to address the barriers identified and to create resources that facilitate the introduction of bioeconomy concepts into schools. These materials cater to various stakeholders, such as teachers and school heads, and even extend to central-level educational procedures.

We took into account diverse actor groups described in the report. All the materials were developed in collaboration with parents (the Stitching International Parents Alliance is one of the BioBeo project partners), and followed professional guidelines developed by the IPA on engaging parents and students of all ages effectively. You can find these materials on the BioBeo website www.biobeo.eu. They are also part of the Digital Handbook, a digital companion to this report, posted on the same page.

7. Sources

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