Summary

ICA Community of Practice for Bioeconomy Education

Colloquium 2022

Interdisciplinary education for the bioeconomy: Embedding the mindset of the bioeconomy in the curricula of Bachelor degree programmes

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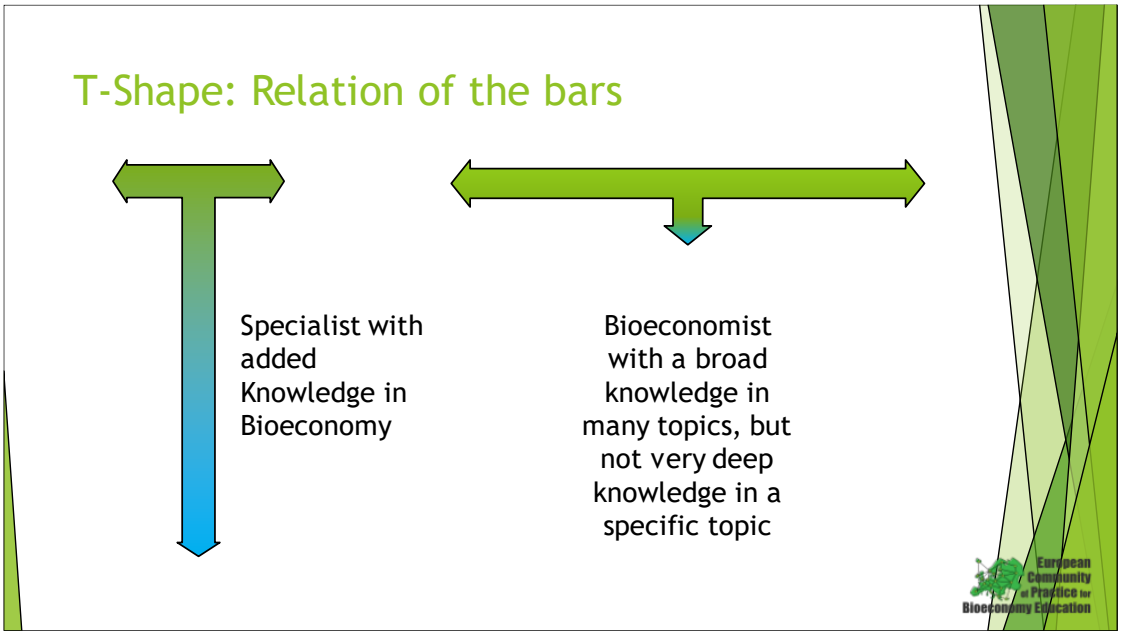
The 2022 ICA-CoP-Bio-Edu[1] Colloquium focused on education for the bioeconomy at the Bachelor level, with the focus on the ambition to develop the mindset of students for the sustainable circular bioeconomy. Students follow many different Bachelor degree programmes, such as agriculture, food science and biotechnology, which can provide opportunities for careers in the different fields of the bioeconomy. However, many graduates on leaving education are not aware of the scope of the sustainable circular bioeconomy and the career opportunities. But employers in these sectors need staff who bring the perspective of sustainable circular bioeconomy to their job in a particular workplace within the bioeconomy sectors.

Thus the goal of the Colloquium was to address how such an interdisciplinarity mindset of the sustainable circular bioeconomy could and should be embedded in the curricula of these many existing specific Bachelor degree programmes, related to the many disciplines underpinning the bioeconomy.

[1] The **ICA Community of Practice for Bioeconomy Education (ICA-CoP-Bio-Edu)**, which is a network of individuals that act as educators in the bioeconomy world, introduces an annual workshop (Colloquium). This and the upcoming workshops are designed to share experiences and good practices among educational actors to enhance the quality, offer and diversity of education for the sustainable circular Bioeconomy in Europe, recognising the different educational sectors and regional perspectives. See here.

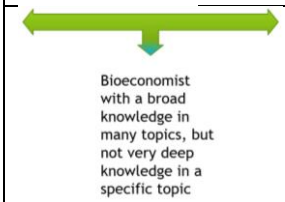
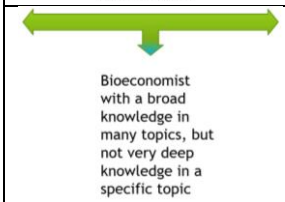
The question was posed in terms of the **concept of the structure of degree programmes based on the T principle**. How to present the interdisciplinarity of the sustainable circular bioeconomy, the cross bar of the T in a degree programme with the specialisation portrayed by the vertical bar of the T? How should the balance be made between the cross bar and the vertical bar during the delivery of the curriculum? What learning trajectory steps should be made from the first year to the final year of the curriculum of a Bachelor degree programme to embed the mindset of the sustainable circular bioeconomy in the student's experience?



As the starting point for the discussion at the Colloquium several invited speakers from all over Europe presented their specific Bachelor and Master programmes; or other specific teaching and learning activities. All the programmes presented aimed to teach that the bioeconomy is the key to a bio-based, sustainable world, in which nature and humans live in harmony in a positive economy. The spectrum of knowledge transfer in the different examples ranged from the simple creation of awareness about how a discipline is connected to the bioeconomy; over the transfer of concrete disciplinary and interdisciplinary bioeconomy knowledge; to complete "Bioeconomy-only" study programmes. The speakers did report about their starting situations, the challenges that had to be overcome and the learning trajectories they had to follow (see table 1).

The presentations showed that many various paths can and have to be followed. For all the case studies the starting situation was very different, and the development processes of the specific programmes were strongly influenced by the existing disciplinary structures, faculties and other institutional constrains. Besides these institutional limitations and existing frameworks, the local and regional circumstances, like the local industry demands and thus the employee market as well as the local, regional, and national policy and frameworks had an additional impact.

Table 1: Case studies presented at the Colloquium.

Position in the T-shape	Presenter	University	Case: Type of teaching activity	Link to the presentation
	Antonio Marzocchella	Università degli Studi di Napoli Federico II, Italy	Master and Minor programmes with strong link to bioeconomy industry	Link
	René van der Burgt	Avans University of Applied Sciences, Netherland	Course module in Exploration as basis for broader thinking in different Bachelor programmes	Link
	Anita Korporaal	Avans University of Applied Sciences, Netherland	Course module in CoCreation for different Bachelor programmes	Link
	Charlotte Voigt	University of Natural Resources and Life Sciences (BOKU), Austria	General concept of disciplinary Bachelor programmes with an interdisciplinary backbone	Link
	Paavo Kaimre	Estonian University of Life Sciences, Estonia	Mandatory course “Fundamentals of Bioeconomy” for all Bachelor programmes	Link
	Mona-Anitta Riihimäki	Häme University of Applied Sciences, Finland	Interdisciplinary Bachelor programme “Information and Communication Technology, bioeconomy”	Link
	Sebastian Goerg	Technical University of Munich, Germany	Full Bachelor programme “Bioeconomy”	Link

But which **strategic approaches** can be deduced from those reports to embed the delivery of this mindset in all higher Education programmes related to Bioeconomy? All case studies had a common basis in terms of content and overarching learning outcomes (with different proportions of, and varying depths in the following topics), which were:

1 Basic Knowledge:

To implement the Bioeconomy mindset, at least a basic understanding and basic knowledge in central disciplines is necessary, which include: Natural and Environmental Sciences; Engineering; Logistics; Economy and Business; Social Sciences; Basic Mathematics, Statistics and Computer Sciences. These disciplines are the backbone of all processes relevant to Bioeconomy and for the development of a interdisciplinary mindset and simply to enable communication between these disciplines, a general understanding of the according main concepts is needed. However, most of these subjects are common to all science programmes in the life sciences already to a certain extent.

2 Needed Skills:

One central needed skill is interdisciplinary thinking and acting (including communication skills and ability to acquire new knowledge in relevant fields), to bridge disciplinary boundaries and to enable transformative learning. Further the ability for Design-Thinking and CoCreation has been identified as basis for the development of problem-oriented solution development in teams, which should be done with an awareness for the "big picture". Additionally identified was the ability to anticipate future developments as well as leadership skills as prerequisite for being a "Change Agent" towards bioeconomy and for entrepreneurship. They can be developed along concrete examples in interdisciplinary student teams ideally in cooperation with industry partners or other relevant stakeholders. The development of this interdisciplinary thinking, encompassing the circular sustainable bioeconomy, is key to creating the mindset of our students for engagement within the bioeconomy and to see the complexity within the big picture of the bioeconomy. This is a central concept to be developed in the cross bar of the degree programme structure discussed above.

3 Creation of Awareness for Sustainability:

Overall it was agreed that an integral part of bioeconomy education is to create an awareness for sustainability at each level (personal, local and regional, global and in time). There is a need for intergenerational thinking and responsibility for the future by recognizing planetary boundaries, and as a basis safeguarding biodiversity and ecosystems. This is going along with social acceptance of the bioeconomy concept to create social equity along with human ethics.

It was agreed that these points built the **knowledge and skill backbone for sustainable circular Bioeconomy Education**. For the embedding of this backbone into the curricula at specific teaching institutions the national, regional, local and institution specific circumstances need to be considered. That means, there is a need to create individual and specific concepts for embedding the mindset of Bioeconomy at each institution, but ideally, they are developed along best practice examples to avoid problems, which have been experienced similarly by others and could be easily overcome with the according knowledge of experience.

Identified prerequisites for the development of such specific programmes are:

- To create possibilities for exchange. A first step is the format of the ICA-CoP-Bio-Edu colloquium. But this needs to be further developed, for example with a digital and easily accessible repository of case studies. These case studies should represent the whole spectrum of different forms and curricula that have been established already elsewhere, like they have been presented at the colloquium, including the description of difficulties and solutions. But such a repository would need a stable and long-lasting centralized funding.
- To engage the teachers in developing curricula, which address the discipline specific contribution to Bioeconomy along concrete examples, as they are the one's who know such examples. But to step into a new field – at least for some teacher – it is necessary to create a safe and inspiring learning environment for teachers and students to test new ideas and formats of teaching.
- To foster more collaboration with the local and regional industry in education projects. Such a stronger interaction between industry is strongly recommended as provider of jobs, as ideal place for internships as well as provider for examples, which can be used as "problems to be solved" in students' interdisciplinary teamwork. Such a collaboration could highly increase the interest of students in that topic.
- To interconnect teaching activities between primary and secondary school education; higher education; VET education; and activities in communication to the public community, as there is a clear need to change the mindset for Bioeconomy at each level of age and educational status.
- To identify idols and more Ambassadors for the Bioeconomy. The "Bioeconomy Youth Ambassador" initiative of the European Commission is a first and powerful step in this direction.

To truly develop the mindset of students for the sustainable circular bioeconomy, reference to it must be made in courses from year 1 to the final year – embedded in the learning trajectory of the specific Bachelor degree programmes relating to the bioeconomy. The starting point in developing this learning trajectory is to define the overall **learning outcomes** for achievement of such a mindset. At the Colloquium it was suggested that a central learning outcome for all learning formats relevant to the bioeconomy must be:

"*The student will be able to describe the main components and their linkages within the sustainable circular bioeconomy, and place their own specific competences within this framework of the sustainable circular bioeconomy!"*

This goal needs to be achieved.

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