IMPROVING BIOECONOMY EDUCATION THROUGH ACTIVE LEARNING: A PATH TO INNOVATION AND SUSTAINABILITY IN HEIS

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ABSTRACT

The Green Deal, which was approved by the European Commission in 2020 and includes several policy-related initiatives supporting the transition to carbon neutrality by 2050, has made the bioeconomy a central topic in European Union policymaking in recent years. In the years to come, it is anticipated that national and European policy support for the bioeconomy will continue to grow (Paris *et al.*, 2024).

The bioeconomy focuses on the sustainable use of biological resources for food, energy, and industrial applications, being a key driver of economic growth, environmental stewardship, and sustainability. Although this has been mostly seen as a purely technological effort, it is insufficient and would not effectively address global sustainability issues. Consequently, integrating active learning methodologies within Higher Education Institutions (HEIs) curricula is crucial for fostering innovation and sustainability in the bioeconomy sector. Contrary to passive teaching methods, which usually fail to equip students with the interdisciplinary skills and innovative thinking necessary to address the evolving challenges of this field, since it is focused on the teaching role and the content, using passive methods like lecturing or teacher presentations (e.g., Hartikainen *et al.*, 2019), we want to explore the impact of active learning education on bioeconomy, highlighting how problem-solving, experiential learning, and cross-disciplinary collaboration can lead to sustainable solutions and economic resilience (Kozanitis and Nenciovici, 2023). Creative learning approaches such as design thinking, project-based learning, and digital simulations engage students in real-world problem-solving, fostering critical thinking and adaptability (Theelen *et al.*, 2019; Yu, 2024).

By embedding these strategies into bioeconomy curricula, HEIs can cultivate professionals who possess technical expertise and demonstrate the creativity and ingenuity required to develop sustainable bio-based solutions. Moreover, collaborative learning environments that connect students with industry stakeholders, policymakers, and researchers enhance knowledge exchange and improve employability in the bioeconomy sector.

Beyond technical skills, active learning practices offer numerous benefits, including enhanced problem-solving abilities, deeper student engagement through interactive experiences, and increased resilience in addressing complex sustainability challenges (Merovci and Dimov, 2024). It also fosters an

ISSN: 2547-8516
ISBN: 978-9925-628-05-6

entrepreneurial mindset, empowering students to develop innovative business models that contribute to the circular economy (Renfors, 2024). By promoting teamwork and interdisciplinary collaboration, creative learning prepares graduates for dynamic professional environments where cross-sector partnerships are vital in tackling global sustainability challenges.

According to Kalnbalkite *et al.* (2022), given the Green Deal framework, the question of how the bioeconomy's objectives will be met is becoming increasingly significant, and HEIs are vital organizations in accomplishing these objectives by putting competence-based study programs into place, producing highly skilled bioeconomy specialists.

This study aims to examine some case studies of universities that have successfully integrated creative learning methodologies into their bioeconomy curricula, to illustrate best practices in merging creativity, sustainability, and technological advancements to enrich student learning experiences. In addition, we want to provide some policy recommendations to support HEIs in adapting their curricula to align with bioeconomy priorities.

For example, Urmetzer *et al.* (2020) assess four university bioeconomy Master programs in Europe (Finland, Germany, Netherlands, and the UK) using a methodology that combines semi-structured interviews and keyword-based content analysis of the module descriptions. The analysis shows that crucial components of transformational knowledge, such as participation, communication, and decision-making abilities, are included in the curricula of all four programs. On the other hand, the programs include implicit skills concerning to the ability to modify and reflect personal beliefs. In addition, the results show that the courses are primarily designed to take transformative knowledge transport into account, and all of them include communication skills and participation strategies.

Pink *et al.* (2024) assess how the bioeconomy is viewed, understood, and positioned in the HEIs research and education, considering universities in the Czech Republic, Poland, Portugal, and Spain, conducting a questionnaire survey of students. The results show that a traditional approach to the bioeconomy, which is related to ecological and agricultural elements, dominates the academic community under study. Although the benefits of the bioeconomy for the environment are recognized, respondents are less aware of its importance from a socio-economic point of view. The authors concluded that there is evidence that education and research in the field of the bioeconomy is inadequate, suggesting that there is no relationship between the national strategy on the bioeconomy and social awareness of this issue.

We know that embracing creative learning within bioeconomy education is vital for producing skilled graduates capable of driving sustainable innovation. HEIs must adopt forward-thinking educational strategies encouraging creativity, collaboration, and real-world application, bridging the gap between academic knowledge and industry needs. By doing so, they can play a pivotal role in ensuring the

ISSN: 2547-8516
ISBN: 978-9925-628-05-6

continued growth and sustainability of the bioeconomy sector in an era of rapid technological and ecological transformation.

Keywords: Bioeconomy, Higher Education Institutions, Active Learning, Innovation, Sustainability.

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ISSN: 2547-8516
ISBN: 978-9925-628-05-6