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## A COMPETENCY-BASED APPROACH TO THE INTEGRATION OF SUSTAINABLE DEVELOPMENT AND ECODESIGN INTO ENGINEERING EDUCATION

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Ecodesign and eco-efficiency are becoming central elements in shaping the competencies of future engineers and designers who are capable of developing products with reduced environmental impact. The integration of ecodesign into educational curricula fosters critical thinking regarding product life cycles, the use of renewable materials, and the minimization of resource consumption in accordance with the principles of the circular economy [1]. Practical implementation of ecodesign courses provides not only theoretical knowledge but also the development of project-based competencies through real-world industry collaboration cases.

Against the backdrop of global social and environmental challenges, sustainable development is being integrated into engineering education programs through transformative learning, which combines theory, practice, and measurable learning outcomes. The application of a transformative approach enables the formation of value-based, social, and professional competencies required for addressing complex environmental problems in professional practice [2].

Contemporary engineering education must reconsider design thinking by incorporating sustainability principles, including environmental awareness, systems thinking, and consideration of the environmental impacts of products and technologies. This approach broadens the traditional engineering paradigm, transforming engineering projects into instruments of sustainable development [2].

Assessment of learning outcomes related to sustainable development in engineering programs should extend beyond technical knowledge and include the ability to solve interdisciplinary sustainability challenges, as well as the capacity for reflective analysis of one's own projects from social, economic, and environmental perspectives [3].

A competency-based approach, particularly through the inclusion of environmental, digital, and interdisciplinary components in engineering curricula, plays a crucial role in ensuring graduates' readiness for contemporary professional challenges. Such an approach enhances the flexibility of professional career pathways and supports adaptation to evolving labor market demands [4].



**Fig. 1. Ecodesign and Sustainable Development in Engineering Education**

For the effective integration of sustainable development into engineering education, it is necessary to employ active learning methods (problem-based learning, project-based learning, case studies, and interdisciplinary projects), which enable students to apply knowledge in practice and develop transversal competencies in line with international standards.

### References

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