

Designing Interdisciplinary E-Learning for Complex Systems: Insights from the LEAP Erasmus+ Project

Gulistan Cigdem Yalcin , Guido Caldarelli , Frederik Liljeros , Michael Kanetidis , Maria Tsouchnika , Panos Argyrakis

Istanbul University, Turkey

Abstract

As a modern society, we are surrounded by real-world complex systems across many domains, including technological, economic, energy-related, and social systems. Exploring this interdisciplinary environment, which reflects complex natural and man-made systems, also requires educational approaches that transcend traditional disciplinary boundaries. In this context, we design and develop online asynchronous course modules within the framework of e-learning, as an Erasmus+ project titled “LEAP: unLocking carEer potentiAl with comPlex systems, data analytics and machine learning”. This curriculum consists of core courses in data analysis, machine learning, and complex systems, aiming to support understanding of complex real-world problems. It adopts a modular MOOC-style structure and supports flexible learning while fostering both conceptual understanding and practical skills. The “Complex Systems and Applications” course is specifically designed to introduce learners from diverse backgrounds to the fundamental concepts of complex real-world problems and to enable them to explore their career potential in various fields. These learners may include students, graduates, as well as individuals seeking career development or transition into ICT-related fields. In this presentation, we provide insights into the challenges and opportunities of designing interdisciplinary e-learning content on complex systems across various disciplines. Early feedback and planned evaluations indicate that the modular, interdisciplinary structure helps develop transferable analytical skills in complex, data-driven contexts. This contributes to the development of innovative e-learning frameworks for complex systems and data-driven fields, aiming to help bridge the gap between academia and industry. Such a bridge is supported through the inclusion of real-world case studies and complex systems applications reflecting current ICT market needs presented in the course.

Keywords: Complex Systems; E-Learning; Erasmus+; ICT Skills Gaps; Real-World Problems