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Innovative STEM teaching practices in Albania towards European Integration

Teaching Course Syllabus

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Introduction

The annual Interdisciplinary teaching course “**STEM and Digital Transformation**” will be divided in two parts.

The First Part – **Part A** - will directly address the application of Trusted Smart Statistics (TSS), a new concept that is under development in the European Statistical System.

(Dr. Endri Raço – 21 hours each year).

Part A includes topics such as:

- 1) The role of Big Data and Data Analytics in the policy life cycle: EU approach
- 2) Official Statistics: Albania and Europe
- 3) The resources available and their ability to meet European Statistics requirements.
- 4) Trusted Smart Statistics: Introduction and change they bring
- 5) TSS concept and the discussion related within the European Statistical System

The Second Part – **Part B** – will evaluate the new directions of European Union guidelines on STEM and how they can impact the economic growth of Albanian society. The part will analyze best key practices from other European countries.

(Dr. Joan Jani – 21 hours each year).

Part B will include the following topics:

- 1) Guidelines of EU policies in STEM.
- 2) The STEM education in Albania and the adaptation of European policies in education.
- 3) Examples of scientific competences include argumentation.
- 4) Problem solving, modeling, innovation using the new technologies
- 5) Encouraging creativity, design and investigation as skills needed for the education process of young scientists in the contents of European Economy.

The course will take place first semester of each year.

The series of seminars “**Gaining experience in automated Electronic Design Systems based on Micro controllers**” (Dr. Joan Jani – 14 hours each year) focuses on:

- 1) The design and implementation of a STEM project according to European standards.
- 2) The role of critical thinking, creativity, collaboration and practices used in project-based learning.
- 3) How automation is changing the learning experience - the Arduino Programming test case
- 4) Modeling and Representation - Hand-on investigation using infrared sensors for measuring distance.
- 5) Scientific investigations, and engineering design - Temperature measurement test case
- 6) Introduction to Python Programming Language.
- 7) Integration of Python with the Arduino micro-controller.
- 8) The framework of STEM literacy and the adaptation in school curricula.
- 9) Creating a web page with data acquired from the micro-controller.

The series of seminars “**TSS concept and role of Big Data inside European Statistical System: Models and applications in Albanian context**” (lectured by Dr. Endri Raço – 14 hours each year) focuses on:

The role of big data and data analytics in the policy life-cycle: EU approach

- 1) Data analytics and big data - present and future
- 2) The approach identification and selection of relevant cases: Albania context toward European Model
- 3) Official Statistics: Albania and Europe
- 4) The resources available and their ability to meet European Statistics requirements.
- 5) Statistical Confidentiality and Data Protection: European standards and challenges
- 6) Developing, producing and dissemination European Statistics while respecting scientific independence
- 7) Quality statistics. Adequate tools, procedures and expertise.
- 8) Trusted Smart Statistics: Introduction and change they bring
- 9) New data and their impact to official statistics: European example
- 10) Availability of new digital data sources, new technologies, and new behaviors in Statistical Offices
- 11) Eurostat concept of TSS: Vision and reality
- 12) TSS approach using Big Data concept: Benefits and challenges
- 13) TSS concept and the discussion related within the European Statistical System

The series of seminars will take place first semester of each year.

The intensive course “**Introducing EU and best practices and policies on STEM**” (Dr. Meljana Bregu – 10 hours each year) will introduce for the first time at PUT, EU contribution on the development of scientific research, the EU opportunities, and projects also the guidelines and contribution of EU on STEM and gender equality in Higher

Education. The intensive course will be highly inter-active with case studies and simulations. The intensive course “**The application of algebraic methodology as a foundation for new software technology and digitalization**” (Prof. Dr. Kostaq Hila – 10 hours)

Dr. Endri Raço – (5 hours each year) and Dr. Joan Jani – (5 hours each year) addresses the application of algebraic methodology as a foundation for software technology, and to examine how it can be used to provide practical mathematical alternatives to the ad hoc methods commonly used in software development.

In particular course takes in consideration EU best practices and advances on using this methodology in data security and high-security cryptography for the future generation.

Final Workshop “**STEM in Albanian higher Education system**” will contribute to present the results of the module, but also the research work on STEM and EU issues to a broader audience, such as civil society members focused, and institutional actors involved in the process.

To impact the mentioned target group Dr Bregu will organize in collaboration with Network of Albanian Women in STEM the “ScienceFemSaloon” a series of informal meeting, one meeting in three months, where young women, students and women in STEM career will discuss the gender equality problems that women in STEM face in Albania.

STEM in Albania – Erasmus and Week Info Day – promotion event.

Suggested Literature:

1. Roungos, Georgios, Christos Kalloniatis, and Yiannis Matsinos. "STEM Education in Europe & the PISA Test." *Scientific Educational Journal "educ@ tional circle"*, 8 (3), 177-187 (2020).
2. Costello, Eamon, et al. "Government responses to the challenge of STEM education: case studies from Europe." (2020): 1-36.
3. Estévez-Mauriz, Laura, and Roberto Baelo. "How to Evaluate the STEM Curriculum in Spain?." *Mathematics* 9.3 (2021): 236.
4. Nite, Sandra B., et al. "Increasing STEM interest through coding with microcontrollers." 2020 IEEE Frontiers in Education Conference (FIE). IEEE, 2020.
5. Svistkov, Alexander I., Anton A. Sutchenkov, and Anton I. Tikhonov. "STEM and STEAM technologies in problem solving with python." 2021 3rd International Youth Conference on Radio Electronics, Electrical and Power Engineering (REEPE). IEEE, 2021.
6. Schäfer, Christoph. *Quickstart Python: An introduction to programming for STEM students*. Springer Nature, 2021.
7. Buachoom, A., A. Thedsakhulwong, and S. Wuttiptom. "An Arduino board with ultrasonic sensor investigation of simple harmonic motion." *Journal of Physics: Conference Series*. Vol. 1380. No. 1. IOP Publishing, 2019.
8. Auffray, Charles, et al. "Making sense of big data in health research: towards an EU action plan." *Genome medicine* 8.1 (2016): 1-13.
9. Beine, Michel, Arnaud Dupuy, and Majlinda Joxhe. *Migration intentions: Data from a Field Study in Albania*. University of Luxemborg, Faculty of Law, Economics and Finance, 2020.
10. Maass, Katja, et al. "The role of mathematics in interdisciplinary STEM education." *ZDM* 51.6 (2019): 869-884.