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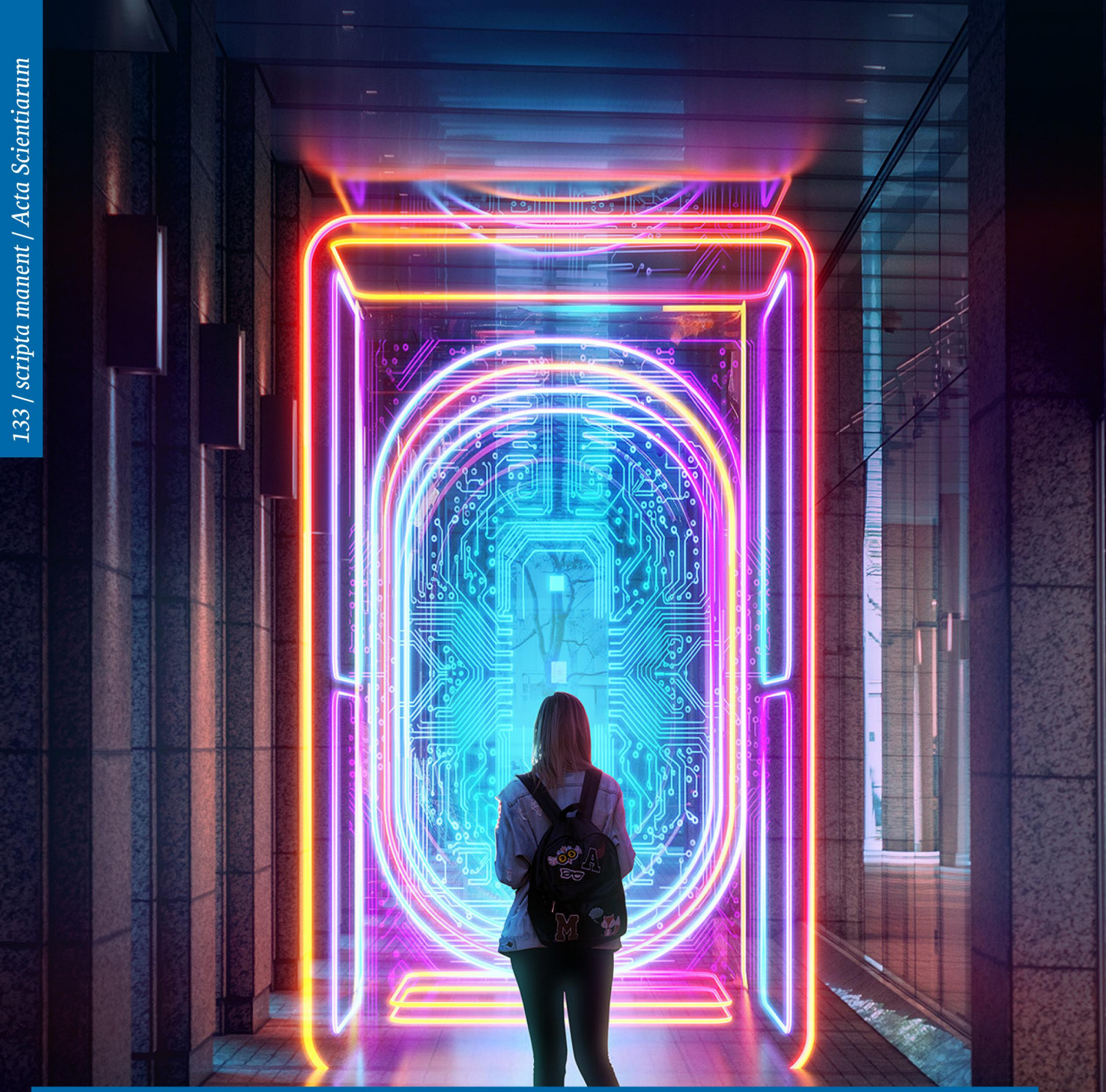

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PANEL I
TECHNOLOGICAL TRANSFORMATION AND ECONOMIC SUSTAINABILITY

Education for sustainable development as key enabler for sustainability and transformation of societies

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Abstract

There is general agreement that adequate education is a prerequisite for achieving sustainable development. It means that any transitions require suitable education. In the years 2015-2017, an educational project was implemented with the aim of increasing sustainable development and pro-ecological attitudes in Serbia and Bosnia and Herzegovina. The project, financed by Visegrad Fund, involved representatives of institutions supporting education for sustainable development (ESD) from 6 countries: Bosnia and Herzegovina, Czech Republic, Poland, Serbia, Slovakia and Hungary. The result of the project is, a still current and popular, publication for teachers: "Sustainability in everyday life". This is a collection of lesson plans for students aged 10-14, devoted to how we can take care of the natural environment and the wellbeing of people through our lifestyle and everyday behaviours. The modules of the textbook were improved, changed and corrected by each partner and finally tested in each country by nearly, in general, 250 students.

The project started in 2015 together with Agenda 2030 and almost 5 years have passed since the end of it. Still it can serve as a model of international cooperation in the field of ESD. The aim of the publication is to indicate how international educational projects such as project Visegrade Plus contribute to the implementation of the Sustainable Development Goals and transformation of societies. The example discussed concerns the Western Balkan countries: Serbia and Bosnia and Herzegovina.

Key words: *education, sustainability, education for sustainable development, cooperation, transformation*

Introduction

The 2030 Agenda is a resolution adopted by the UN General Assembly in 2015. This initiative builds on decades of work by the UN and global society to advance the concept of sustainable development and guidance on its practical implementation. At the heart of the Agenda 2030 are the 17 Sustainable Development Goals with 169 concrete targets which provides a guidance for social development with aim to achieve wellbeing for all people while respecting the environmental limits of natural resources use, now and into the future. The co-authors of UNESCO's publication: "Issues and trends in Education for Sustainable Development" Alexander Light, Julia Heiss and Won Jung Byun stats that "the SDGs recognize that all countries must stimulate action in the following areas – people, planet, prosperity, peace and partnership – in order to tackle the global challenges that are crucial for humanity. Achieving these goals requires a profound transformation in the way we think and act"

There is general agreement that education is crucial factor for achieving sustainable development. Without appropriate education, progress in any area of sustainable development, such as health care, sustainable consumption and production, climate protection, counteracting poverty or striving for equal rights, is not possible:[1]. Educational systems are critical to achieve the transition towards sustainability as they equip learners with the knowledge, skills and attitudes needed to re-orient social structures and systems.

[1] http://www.unesco.pl/662/ [access 10.02.2024].

The use of MOOCs in University Teaching andLearning

Case study: Constructing a MOOC course for teaching physics in higher education

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Abstract

In the sector of higher education, it is assumed that lecturers have teaching abilities due to their high academic qualifications (Kersten, 2018). But the massification of higher education, one of the most challenges of modern higher education - particularly evident in the Albanian University Landscape - is often coupled with a shortage of well-trained academic staff and the reliance on inexperienced lecturers, especially in terms of didactic competencies, and also with a greater number of students, with personal lower expectations. Living in a technological era, open online platforms can serve as a valuable tool to bridge knowledge gaps. This paper examines the use of Massive Open Online Courses (MOOC) in university teaching and learning. The primary objective is to identify the patterns of MOOC development in both Italy and Albania, utilizing data gathered from official institutional websites. This process, guided by key concepts, serves as the foundation for creating a theoretical sample about MOOCs. The secondary aim is to present a curricular module at level 1, design for qualification of university teaching staff in basic course of Physics. This module is structured around two axes: theoretical material from the field of pedagogy and how this pedagogy can be applied in physics teaching and learning. It is tailored for those teaching physics courses in universities specializing in natural sciences and engineering. Some key conclusions drawn from the study include the need for Albanian universities to embrace new platforms and offer technology-based courses. In Italy, three platforms provide MOOCs, with one being a project of the Ministry of Education, University, and Research. However, the Ministry of Education and Sports in Albania currently lacks a strategy regarding MOOCs. The spectrum of MOOCs varies in terms of level, subject coverage, duration, targeted learning community, and teaching language, emphasizing that these courses are products of collaborative and interdisciplinary partnerships.

Key-words: *Technology, MOOC, higher education, university pedagogy, physics.*

Introduction

Historically, the Albanian model of higher education system has worked based on the Humboldtian model: research and teaching are included within the professor role and are integrated at the organisational level, the same model that Götze and Schneijderberg (2022) use when define the German Model of Higher Education Institutions.

Today, massification is one of the main characteristics of higher education. The massification of higher education, together with the increasing internationalisation led to the need to ensure quality of higher education in the changing environment in internationally acceptable and trustworthy ways. (Wächter *et al*, 2015). In this perspective, the discourse – defined as use of language for a certain social practice - must be understood to be constituted by, and constitutive of, social reality (Nokkala, 2016). This new social practice appeals for a new discourse regarding Albanian Higher Education Institutions landscape. The starting point is critical inquiry, the term used to describe a process for the systematic evaluation of process, based on empirical data and is a combination of deliberation and action (Karlik, 2010).

Albania is home to 42 higher education institutions, comprising 15 public institutions and 27 private ones, with some operating for profit and others not (ASCAL, 2024). Empirical data highlights that this substantial number of higher education institutions in the country is associated with an increasing student enrolment, typically restricted for most study programs only by an upper secondary school average grade of 6.5. Moreover, there is a notable rise in the numbers of non-traditional learners, a trend that is underscored, according to Irvine *et al*. (2017). This trend supports the consideration for introducing competency-based education in university settings.

Topics that needs to address are many: The massification of higher education is accompanied mostly with a shortage of well-trained academic staff and - often – with the employment of inexperienced lecturers, especially regarding didactic competencies. The usual educational biographies of university teachers, especially in the technical and natural sciences universities, do not include educational or didactic studies. In the sector of higher education, the traditional discourse assumed that "lecturers have teaching abilities due to their high academic qualifications, but the evaluation results of the teaching quality in higher education significantly show that this assumption is only partially correct" (Kersten, 2018).

But the challenge quality *vs* quantity is outdated. The fact is that we can't undo the massification of universities. What we can and shall do is to be prepare for this new dimension of higher education: massification. We are part of a knowledge society, a concept that stands in relation to the management and creation of knowledge in companies and organisation, a more academic term, as a more integral alternative to the concept of the information society (Galán *et al*, 2019). Information is overloaded and labour markets are in continually change. Organisations are transformed in the intelligent ones, characterised by an increased organised knowledge, in the form of digitalised expertize, expert systems, organisational plans and other media (Evers, 2010). However much welcomed this dynamism may be, it does force universities to reassert their normative control over knowledge production: the university are increasingly compelled to exert governance over the market (Fuller, 2018). The new challenge for universities is to keep this authority without enjoying the backup of the state. In most of the countries, including Albania, universities are not the only knowledge agents of the state. Part of this challenge is the requirement to gear university education to the dynamic demands of the economy and technology plays a key role (Kersten, 2018).

Knowledge transfer is a one-way process between universities and external agents and organisations. This concept is used to describe a situation where knowledge is generated, applied or made useful by boundary crossing exercises between non-university settings and universities (Little *et al*, 2016). Living in the era of Information and Communication Technologies, the dissemination of information and the transmission of knowledge through education and training can happen and be found on untraditional different environment. Open online platforms are one of them and serve as a tool to bridge knowledge gaps and improve didactic barriers. ***In the burst of hi-tech bubbles after 2000, we need to adopt a more sombre tone, emphasising challenges and urgency of change, rather than opportunities of change (Nokkala, 2016). E***mbracing new pedagogical approaches is becoming an emergency.

MOOCs in Higher Education Institutions as a pedagogical approach

MOOC stands for Massive Open Online Courses and represents a new opportunity for digital learning. MOOCs are a good tool to support learning combining the academic tradition and innovation of digital technology (OECD, European Union, 2019). MOOCs are seen as a new pedagogical approach in this new era.

Using MOOCs in higher education must see in terms of options for access in training and education programs, as intellectual and moral education initiatives to insure continuity and sustainability (Galán *et al*, 2019). MOOCs extend the environment in which the education takes place and thus foster lifelong learning, and are also an opportunity for firms who want to invest in human resources development and training, with a lower cost and more flexibility (OECD, European Union, 2019).

Usually the access is free and students can pay if they want the certificates recognising their enrolment and acquisition of knowledge related to the courses.

Some of the characteristics of a MOOC, based on the work of Galán *et al* (2019) are:

- Openness and accessibility: information location is located on line, often in distance of learning communities; accessible to anyone, regardless country of origin, previous training
- Size of the educational community: no limits of the number of participants (easily exceed to thousands)
- Learning process is shared: there is not hierarchical relationship between teacher-students; new materials and learning strategies; minimal intervention of teaching staff; students can become generator of the content.

The culture of the institution plays a key role in those collaborative and interdisciplinary partnerships in developing MOOCs. This collaborative processes stimulate new conversations around our own understanding of scholarships and pedagogy, serve to raise new questions, to challenge our beliefs and assumptions and to open channels of communication that explore new alternative best practices (Deven *et al*, 2010).

The discussion on this untraditional courses, provided on this new era, continues with the used pedagogical strategies, and the motivation and involvement of students. The common questions are those raised by Matthews (2012): What is taught? How it is taught? What is learned? How it is best learned?

Some questions around participation are pointed out by Bayne and Ross (2015): MOOC, which relied on network, needs to produces content, not just to consume; level of discussion and motivation is low.

Time preparation for a MOOC is also a factor to be taken in consideration, together with costs (including video production and copyright clearance) and coordination time. In the first wave of MOOC, University of Edinburgh report that this time was around 30 days of academic (faculty) time for a 5-6 weeks MOOC (Bayne and Ross, 2015).

Methodology

Research planning in this paper is based on qualitative methods. The first part of design was to identify the patterns of MOOCs developing in Italy, our neighbour, and in Albania, from macro level perspectives. The main sources to collect data were those found in the internet, on the official websites of Ministries of Educations and higher education institutions for both countries, using Google as a search engine. This investigation, drives by 4 key concepts, was evaluate as a base to create a theoretical sample about the MOOCs. Key concepts employed were: 1. MOOC levels, subject covering, targeted learning community 2. the lengths and the prerequisites (skills level), 3. the teaching language (native or/and foreign language) 4. if are provided in any partnerships. Strategy of seeking, based on key concepts, involved the combination of them, too. At micro level, the aim was to identify the main elements of a MOOC in order to have a comparison reference frame in densifying characteristics of a MOOC in teaching physics.

In the second part, the theories, paradigms, perspectives, concepts on MOOCs, together with the specific elements of a MOOC were used as an orientated approach to construct a MOOC Module in teaching physics, a process that is known by the term of case-to-case transfer.

In this paper, MOOC developing is analysed based on the academic efforts, not the on technical aspect of the preparation, like the process of video preparation, characteristics of the platform or other technical issues.

Research questions

1. Macro level: What are some of the characteristics of MOOCs provided in Italy? Does Albanian Higher Education Institutions provide MOOCs? Does Ministry of Education and Sports of Albania have any strategy regarding the MOOCs?
2. Micro level: What are the main elements of a MOOC? How can be structured a MOOC module in physics?

Data collection

For the first buckle of research questions, the aim was to identify the institutions that provide MOOCs in both countries, and to explore also around four key concepts.

In Italy, based on the report of the OECD (European Union, 2019) and data collected on the internet, MOOCs are offering by those universities:

University of *Naples Federico II*. The platform for this courses, "*Federica* Web Learning" (https://www.federica.eu/en/all-moocs/) is of the University Centre for Innovation, Experimentation and Diffusion of Multimedia Learning at the University of *Naples Federico II*. In this website, are over 500 freely available online courses. "Complete a course and gain a certificate of completion" – is written in the website.

MOOCs are providing in partnership with other education institutions and different agencies, state and private both, like "Consorzio Interuniversitario Sistemi Integrati per l'Accesso", "Università Degli Studi Di Milano – Bicocca", "Università Degli Studi Di Padova", "Università Degli Studi Di Firenze", "Università Di Milano", "Università Di Pavia", "L'orientale - Università Degli Studi Di Napoli", "Università Di Napoli Parthenope", "Università Del Salento", "Università Della Calabria", "Università Di Catania", "Università Del Molise", "Wellesley College", "Agenzia Per La Coesione Territoriale", "Scuola Nazionale Dell' Amministrazione", "Ferrovie Dello Stato", "Istituto Nazionale di Statistica", "Telecom Italia", "Il Mulino editore", "Confcooperative Cultura, Turismo, Sport", "Springer", "Coursera" etc. The length of the courses varied from 2-3 weeks up to 3-years, Bachelor and Master level; the lessons are provided in Italian, but you can find courses provided in English too; the short courses usually are designed for beginners; subjects involve 9 disciplines, from environment, engineering, art, architecture up to chemistry and biology; Federica's degrees in MOOC format are open access and free even for those not enrolled at the University of Naples Federico II.

Politecnico di Milano. The platform for this courses, MOOCs to bridge the gaps ... "Polimi Open Knowledge" is the MOOC programme of Politecnico di Milano (https://www.pok.polimi.it/). This programme offers MOOCs for Bachelor of science, for Professionals, for Master of science, for Teachers, for Researchers, and for citizens. Two course examples are selected from the website, based on the interest of this paper: "Women in Technology" is a 4 weeks MOOC, provided by Politecnico di Milano, IPAG Business School, Lappeenranta University of Technology, PoliHub, The Digital Hub in collaboration with Technological University Dublin, The Shortcut; "Spaces and technologies for smart learning" is again a 4 weeks MOOC, on the role of spaces in teaching, as a key element for educational planning in the classroom and online, provided by the Polytechnic of Milan

Ministry of Education, University and Research of Italy. The platform for this courses, EduOpen. "Free [The] Knowledge for All". https://learn.eduopen.org/, is a project financed by the Ministry of Education, University and Research of Italy, aimed at the creation of a platform for the provision of courses defined as MOOCs by a network of Italian universities and a set of selected partners. The purpose and philosophy of the project is part of the Open and Digital Education movement. From the course catalogue, courses are from 2 hours' length up to 40 hours and provided by Italian universities. This project is in partnership with Learning Management Systems (LMS) of India, CINECA (a non-profit inter-university consortium), GARR (La Rete Italiana Dell'istruzione e Della Ricerca), Blackboard and Paperlit (Content Distribution & Content Monetization).

A pattern of MOOCs, on a macro level perspective, based on 4 key concepts, is summarised in Table 1.

TABLE 1: Pattern of MOOCs providing in Italy

Institutions	MOOC levels (L), topics covering (T), targeted learning community (TLC)			Lengths & the prerequisites (skills level)	Teaching language	Partnerships
	(L)	(T)	(TLC)			
University of Naples Federico II	University level: Bachelor, Master and orientation / based on the market and construction of new skills	+ 500	Wide	4 weeks up to 3-years, skills levels depend by the length and MOOC level.	Italian and Italian or English	Yes / 9 partners
Politecnico di Milano	Bachelor & Master of Science / Researchers/ Professionals / Teachers / Citizens / Design Test	114				Yes
Ministry of Education, University and Research of Italy	Orientation / for teachers / master's degree/ continues training	Impossible to identify a fixed number, but the impression was that this number was very large			English, François, German, multilingual, Italian, Portuguese.	Yes /23 (mostly, Italian HEIs from all over the country)

In Albania, the official website of Ministry of Education and Sports (MoES) of Albania has not any strategy, document, project or initiative regarding the MOOC. Using the word key "MOOC" as search tool in the official website of MoES (https://arsimi.gov.al/) the result was zero for this topic. The same strategy was used to identify if there is any MOOC course provided by Albanian Higher Education but the result was the same: "Sorry, but nothing matched your search terms. Please try again with some different keywords."

However, in the case of Albanian HEIs, it is the need for a parenthesis. Most of the Albanian HEIs are involved in different projects, supported by European Commission. The hypothesises is that some of them, part of one project or another, maybe are provided MOOCs, but the content should be in the project website, often not accessible through official websites of the institution. This hypothesis is based on a case study. LOGOS University College and University "Aleksandër Moisiu" of Durrës are part of MAGNET project, "Managerial and GoverNance Enhancement through Teaching", co-funded by the European Union, in the framework of Erasmus+Programme (ERASMUS-EDU-2022-CBHE-STRAND-1, project number 101083006; three-year project), a consortium of 12 HEIs from Western Balkan. Project leader of this project is Dimokritio Panepistimio Thrakis. One of the deliverables of the project is preparation of at least two MOOCs by each partners, due to date June 2024. Both Albanian HEIs are working on this task. The project platform (https://magnet-moocs.mbg.duth.gr) requires individual subscription, and cannot found neither to LOGOS University College, nor to University "Aleksandër Moisiu" of Durrës official websites. For this case, the justification is because all MOOC are in the process of developing. So, it is difficult to state that none of the Albanian HEIs are not coping with this challenge.

All MOOCs provided by both Albanian HEIs can be categorised as xMOOC, based on the definition of Bayne and Ross (2015): xMOOCs[1] are characterised by a pedagogy short on social contact and reliant on video-lecturer and automated assessment, though based on the same authors the efforts are to make a new categorisation of MOOCs. The pedagogy of those MOOCs is based on behaviourist approach, or said differently learning through repetition and testing.

University "Aleksandër Moisiu" of Durrës is preparing two MOOC courses. Those MOOCs are summarised in Table 2, but are in process of developing (Table 2).

TABLE 2: MOOCs provided by University "Aleksandër Moisiu" of Durrës (both in process, representing here in a short variant)

Coordinator and teacher	Course title	Field / Humanities	Target learning community	Estimated Effort
Dr. Orneda Gega.	Teaching Strategies for Students with Special Needs	Topics: Autism /Autism Science / Children with Attention Deficit /Hyperactivity Disorder (ADHD) / Children with intellectual disabilities/ Children with trisomy 21 (Dawn Syndrome)	Graduates at the Faculty of Education, assistant teachers and specialist teachers in pre-university education, teachers of day-care centers and kindergartens, parents who have children with special needs.	2 hours / week
PhD Olta Qejvani	Europeanization of Albanian universities: from EU legislation to innovative integration	Topics: I. EU legislation and policy for higher education institutions 'Europeanization'. II. Albanian recent developments upon EU law. III. New alternatives from EU practice that urge for implementation for HEI-s in Albania.	This course is appropriate for any student interested in EU affairs, EU integration, but not limited to. The course offers specific knowledge and research for the students interested and focused in EU law, EU integration, international law etc.	2 hours / week

Credits: Dr. Orneda Gega and PhD Olta Qejvani, University "Aleksandër Moisiu" of Durrës, Albania.

[1] *Note*: Based on the same authors (Ibid), the other MOOCs are categorized as cMOOCs: designed to foster processes of 'aggregation, relation, creation and sharing" among distributed groups communicating and collaborating online.

Constructing a MOOC. Case study: Constructing a course module in teaching physics in university

For this part of the study, the specific elements of a MOOC found on those provided in Italy, are the same with the MOOC template developed by Democritus University of Thrace (DUTH), Greece, in a framework of an Eramus+ project, "Managerial and GoverNance Enhancement through Teaching" (MAGNET), supported by European Commission. The template maximizes and highlights findings.

The design of this MOOC is in process and will be provided by LOGOS University College. The first question that had the need for an answer was: Why in physics?

Recently, Albania has experiences some educational reforms in pre-university level. One of them is curricular reform, with an extremely new conception of number of lessons and content base regarding sciences in general and physics specifically. So, physic subject in upper high school is developed with two cycles: the first one has a two year long timeline, from 10-11 grade, where physics is taught as an obligatory subject, with a content base on descriptive nature and reduction in lessons until 2 hours/week; the second one has a one year long timeline, that starts and ends in the period of an academic year, physics is taught as facultative subject, until 4 hours/week, and is chosen only by those that intend to apply in a program study in higher education with scientific focus, such as natural sciences, engineering, medical etc. This fact has a negative impact on the knowledge level of students starting their studies at universities with natural and scientific or technical focus, a fact that is known in Sllovakia, too, (Krišťák *et al*, 2014), though only for the very first reason – reduction in number of lesson taught.

Another justification is the poor academic performance of Albanian pupils in PISA, continually in decline, especially in science and the lack of strategy by the educational authorities to bridge this gap in the next level of pre-university education level, that is means in upper high school. Further, the massification of higher education, which bring at the gate of the HEIs students with a wide diversity in average grade from upper high school. Universities with natural and scientific or technical focus accept candidates based only of the results of upper high school, and there is not the conception of admission competition.

Description of the course (Table 3) is organised based on the template preparing by Democritus University of Thrace (DUTH), Greece. The core concept behind the MAGNET Project is how to enhance pedagogy in higher education, potentially for every subject taught at the university level. It is founded on the "European Strategy for Universities" initiative, which states, "To achieve excellent and relevant higher education, support is also needed to stimulate pedagogical innovation, centered on the learners, with a variety of learning environments and flexible, interdisciplinary pathways" (European Comission, 2022).

TABLE 3: Description of the course (in process of designing and developing)

Asset*	Description
Course Title	Using models in teaching physics in higher education
Course Banner Image	Insert an image
Short Description	The MOOC will provide the methodology of the model and how it can be used in constructing knowledge in physics.
Course Overview	The course aims to inspire academic staff to embrace pedagogy in higher education, recognizing it as essential for creating inclusive learning environments and fostering the development of knowledge. To achieve this, we will delve into the utilization of models in teaching and learning physics, approaching it from a two-ways perspective. Initially, a discussion on the methodology of a model is provided, remarking the fourth dimensions of constructing it. The fifth dimension is to analyse how this model fit with empirical data, and also its validation and/or limitations. In the first part, we will explore three well-known models, Bohr's atomic, Ideal gas and Photonic gas, illustrating how we can present them within the framework of our theoretical model. The idea behind this lesson is that usually teacher teach a theoretical model not as a model per se, but as a sum of different concepts, qualities, behaviours and principles, all under a name. Furthermore, the efforts will be focusing on applying this model in common problems from physics, selected from the mechanics. As part of the methodology surrounding models, another topic will be covered: mapping and concept maps, which aligns with current trends in developing competency-based curricula in higher education. Through this MOOC, you will: • gain familiarity with key ideas of a model in physics, including the manipulation of some known models • develop and practice model method with practical examples • develop and practice methods of mappings and concept map. This MOOC consists of a single module, and the course is designed to be self-paced, allowing participants the flexibility to engage with the content at their own convenience.
Course ID	UP102_Science
Class Start & End Dates	May, 2024 – July, 2024
Estimated Effort	1-3 hours a week
Prerequisites	Recommended experience! Learning community: lecturers of sciences of different years of experiences in higher education; graduate teachers; students of study program in teaching physics, chemistry, mathematics and biology.
Course Staff Picture	Insert a photo

Course Staff Bio	Valbona Nathanaili is a lecturer at the department of pedagogy-psychology at LOGOS University College, Tirana, Albania. She is a Bachelor in physics and a doctoral degree holders in the science of pedagogy, both from University of Tirana. At the undergraduate level, at LOGOS, she teaches the methodology of teaching science and natural sciences.
Course language	This module will be conducted in Albanian languages, with subtitles in English.
Methodology used	Methodology used is lecture based.
Other characteristics	Without credits, without certificates, free participatory

Credits: * Assets are based on the template developed by Democritus University of Thrace (DUTH), Greece.

Curricular structure of this MOOC is of level I, "Fundamentals of design of teaching and learning processes", a classification based on the work of (Hake, 1998), who define three levels:

1. Modul level I Fundamentals of design of teaching and learning processes
2. Modul level II Arrangements of academic teaching and learning
3. Modul level III Structuring of study programs

The curricula of this MOOC course is based mostly on the program of Basic Course of Physics in the first year of bachelor level (University of Vlora, 2024).

Course content

Week 0: Introduction video

Short description: About the initiative; about the project; why this course; hard time for higher education/ importance of pedagogy in higher education; massification of universities and the importance of effective teaching; about the instructor – who I am and what I teach; who can attend.

Source:

Kersten, S. (2018). Approaches of Engineering Pedagogy to Improve the Quality of Teaching in Engineering Education. In: Drummer, J., Hakimov, G., Joldoshov, M., Köhler, T., Udartseva, S. (eds) *Vocational Teacher Education in Central Asia. Technical and Vocational Education and Training: Issues, Concerns and Prospects*, vol 28. Springer, Cham. https://doi.org/10.1007/978-3-319-73093-6_14

Week 1: Methodology of a model in physics

Short description: The first part of this lesson explain the theoretical definition of a model in physics. Models in physics represent the structure of a physical system and/or its properties. Unlike the theory, the model refers to an individual system, which represents the whole class of similar objects. For this, we rely on the fact that the physical properties of the objects are defined. Physics is taught by studying these properties under certain conditions. The conclusions we draw are within these models and theories. The dimensions of a model are designed based on the work of Dayal, & Ray (2008): 1. Systemic structure specifies (composition: internal parts of the system; environment: external agents linked to the system; connections: external and internal causal links); 2. Geometric structure specifies (position: with the respect to reference frame; configuration: geometric relations among the parts); 3. Temporal structure specifies (descriptive models: represent change by explicit functions of time; causal models: specify change by differential equations with interaction laws); 4. Interaction structure specifies (interaction laws, expressing interactions among casual links, usually as functions of state variables); 5. Limitations/ Conclusions / Validation of the model: does the prediction of the model fit with empirical data?

In the second part of the lesson, the aim is structuring three models, Bohr's atomic model, Ideal gas model and Photonic gas model based on the dimensions of theoretical model in physics (Table 4). It is very important to note, that in this paper presentation, laws, diagrams and formulas are excluded.

TABLE 4. Working with models to construct knowledge: A descriptive approach of Bohr Atom, ideal gas and photonic gas (Note: laws, diagrams and formulas are excluded)

Examples	Systemic structure*	Geometric structure*	Temporal structure*	Interaction structure*	Limitations/ / Validation
Bohr's atomic model	electrons and nucleus / / external agents: energy from outside	Planetary model of atom; electrons travel in specific orbits, with a fixed radius, around the nucleus	Equilibrium state/ exciting state	How electron behave when atom is at exciting state / quantization of atomic emission spectra	Based on Rutherford's atomic model. Perfect for Hydrogen Atom and other single electron systems such as He^{+}; Validation: introduction of energetic level / electrons can be thought of as behaving like waves and behaving as particles.

Ideal gas	Particle Number (N) is specified and fixed; gas is homogenous, monoatomic; collisions are elastic;	chaotic movement; Reference frame: container	during collisions particles exchange energy and change the direction of movement; Independent State variables: N, T, V	Classical mechanics. Newton's law are applicable.	Experiments show that all gases behave essentially in the same way, if their densities are not too high, the temperatures are not too low and the pressures are not too high. This suggests the concept of an ideal gas, one that will have this simple behaviour under all conditions. (Resnick et al, 1961). The ideal gas gives no indication of the condensation phenomenon that a real gas experiences at temperatures below its critical temperature. For gases with low density, the effect of fluctuations is noticeable. For 2- and 3-atomic molecules the model needs to be modified
Photonic gas	Photon gas is built from energy stored in the container walls; photons possess both wave nature and particle nature; number of the photons is variable; the external agent: the wall of the blackbody; photons move with the speed of light; the rest mass of photon in free space is zero; space is emptied from the gases.	Reference frame: blackbody, which can be compared with a container.	Independent State variables: T and V. Internal energy function is volume dependent.	Photons are absorbed and emitted continually;	Can be adapt as supplement to the ideal gas (Leff, 2002);

Credits: * Based on definitions of Dayal and Ray (2008)

Sources:

Resnick, R. & Halliday, D. (1961). Physics. For Students of Science and Engineering. Part I. John Wiley & Sons, Inc.

Dayal, D., Bhatt, R. & Ray, B. (2008). *Modern Methods of Teaching Physics*. New Delhy: S.B. Nangia, APH Publishing Corporation.

Week 2 & **3** Working with models to construct knowledge: How to apply the model in practical problems examples from mechanics.

Short description: Mechanics is the oldest branch of physics. We generalize its concepts and methods and use them in other branches of physics. Understanding the principles of mechanics helps us lay the foundations for understanding all of physics. In this lesson, the aim is how we can solve different problems, based on a model. For this, are selected 4 practical problems from classical mechanics, and different steps that we can undertake based on the model. Table 5 shows a general view of the work preparation.

TABLE 5. Working with models to construct knowledge: practical problems examples from mechanics (Note: laws, diagrams and formulas are excluded)

Examples	Systemic structure*	Geometric structure*	Temporal structure*	Interaction structure*	Limitations/ Validation
A ball is thrown vertically upward from the ground with a speed of 24.5 m/s. a. How long does it take to reach its highest point? b. How high does the ball rise? c. At what times will the ball be 29 m above the ground.	System schema: free-body & force diagrams; external agent: earth; don't take in consideration air resistance. Ball is considered as a particle;	choose reference frame based on a coordinate system; use symbols; employ vectors; visualize the structure as a whole;	State variables – time and high; provide comparison of states at different times; write down the equation/s of state.	Interaction map: apply the laws of free motion, first as vector equation and then as numerical equation.	Mechanics/ Kinematics: Motion in free fall; t have two values for h=29 m.

Figure shows two blocks of masses (m_1 and m_2) on a smooth horizontal surface pulled by a string which is attached to a block of mass m_3 hanging over a pulley. Find the acceleration a of the system and tensions in the string.	System schema: free-body & force diagrams; situation map / external agent: earth, horizontal surface, pulley; Blocks of masses are considered as particles;	employ vectors; choose reference frame; visualize the structure as a whole;	State variables – tensions, acceleration.	Apply the second law of Newton; Are tensions equal?	Mechanics/ Dynamics. Assume: pulley has no mass and is frictionless (doesn't change the direction of tension in the string at that point). Make assumptions for a=g?
Consider a solid cylinder of mass M and radius R rolling down an inclined plane without slipping. Find the speed of mass when the cylinder reaches the bottom.	System schema: free-body & force diagrams; situation map/ external agent: earth; friction force is present, otherwise the cylinder will not rotate.	Choose reference frame; visualize the structure as a whole;	At the highest point, the cylinder possesses only potential energy; a part of the potential energy of the cylinder is spent as kinetic energy of rotation around the axis of rotation. State variables: energy, speed.	Interaction map: apply the law of energy conversation.	Rotational Dynamics/ In the cases when cylinder, takes part in translational and rotational motion, both, the speed at the end of the inclined plane is smaller and the time of arrival at the end is greater, compared with cases that is involved only in translational motion.
Atwood's Machine consists of a smooth pulley with 2 masses suspended from a light string at each end – see the figure. Find the acceleration of the masses and the tension of the ring when: 1. the pulley center is at rest; 2. the pulley is in an elevator, descending with a constant acceleration a.	System schema: diagrammatic representation/ situation map/ neglect the mass of the string/ pulley is smooth. external agent: a. earth / b. earth and elevator	Blocks of masses are considered as particles; choose reference frame: case 2, when pulley is in elevator, you need to find a new inertial system.	State variables Tension is the same throughout the string.	Interaction map: find the forces that are applying on each masses; write dawn laws, first as vector equation and then as numerical equation.	Mechanics/ try when elevator is ascending.

Credits: * Based on definitions of Dayal and Ray (2008)

Sources:

Resnick, R. & Halliday, D. (1961). Physics. For Students of Science and Engineering. Part I. John Wiley & Sons, Inc.

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Week 4. Mapping and concepts map in physics

Short description: Mapping and concepts map are useful tools in physics. In this lesson, the concept of map is used on three dimension: mapping, according to Thornton and Marion (2004); concepts map as a form of representation of someone's knowledge about some topic; and situation and interaction map, based on Dayal and Ray (2008). The key word that connect all three concepts is "map", though each of them represent different perspective of approaching knowledge. Table 6 gives a summary of the definitions for each of the terms used.

TABLE 6. Working with the concepts of maps in physics (work in progress)

Mapping	Concepts map	Situation and interaction maps
Mapping as a tool to describe the progression of a system. If we use n to denote the time sequence of a system and x to denote a physical observable of the system, we can describe the progression of a non-linear system at a particular moment by investigating how the (n+1)-th state depends on the n-th state. This relationship $x_{(n+1)}=f(x_n)$ is called mapping (Thornton, S.T & Marion, 2004)	Concept Map as a useful tool for evaluating the instructional sequence or conceptual construction of textbooks for the basic cycle of the course of Physics and Engineering as for high school (Mello, 2017). Based on a concept. Case study: Law of conservation.	Diagrammatic representation (see Table 3, systemic structure and temporal structure)

Sources:

Anohina-Naumeca, A. (2019). Concept Map-Based Formative Assessment of Students' Structural Knowledge. Theory and practice. Cambridge Scholars Publishing.

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Discussions and conclusions

Living in the technological era should not be viewed merely as a redefinition of our experience of time, nor as an opportunity for increased technological advancements. It certainly should not be observed passively. The challenge of actively participating in this era involves embracing every opportunity it presents. Albanian Higher Education Institutions find themselves at a crucial juncture. A growing number of Albanian youth are opting to pursue studies abroad, particularly those with exceptional abilities. It appears that the competition has elevated to a new level: we must not only compete among ourselves but also with ore neighbours. The question arises: Are Albanian Higher Education Institutions adequately prepared for these new challenges?

In Albania, concerning MOOCs, online data indicate that only two Albanian Educational Higher Institutions are currently in the process of developing such courses, but as part of individual strategies and efforts, based only on institutional human resources. From the other side, Ministry of Education and Sports currently lacks a strategy regarding MOOCs and no document in its official website indicate for such an initiative, even at least at the level of discourse. The MOOC gap is becoming another concerning issue in Albanian University Landscape, potentially leading to missed opportunities for educational advancement. Again!

In Italy, three platforms provide MOOCs, with one being a project of the Ministry of Education, University, and Research. MOOCs provided by Italian educational institutions aim to target a community, that involve not only traditional learner, such as part of an educational institution, but also untraditional learner. For the later, factors such as time and geographical location are important, but most important seems to be the challenge of fulfilment.

Essential actors in developing a syllabus for Massive Open Online Courses (MOOCs) are the Faculties of Education and Centers for Teaching and Learning. Their mission is to cultivate inclusive teaching, centered on student learning, and guided by research and practice. These play a crucial role in fostering a culture of collaboration within the institution itself, contributing to the fulfilment of their mission. Particularly in universities with a technical or natural sciences profile, these actors are almost non-existent. Additionally, there is a rare of documented collaboration between Albanian institutions.

The spectrum of MOOCs provided in Italian educational landscape varies in terms of level, topics coverage, targeted learning community, lengths, skills level and teaching language. It was not difficult to design the pattern of MOOCs provided in Italian educational landscape (Table 1), for all three platforms, but it is easy to find the perfect MOOC of your interest and educational background. Further, is very important to emphasize that in Italy, these courses are products of collaborative and interdisciplinary partnerships, from different educational institutions, state agencies, foundations and private or state companies.

In Albanian MOOCs case, in each HEIs, the start was by identifying the academic staff ready to face this challenge, but at both institutions this workload was out of the standard professional expectations – which in the case of a lecturer is four courses per year. Said this, does designing and teaching through MOOC will be considered as part of yearly workload? Of course, determining appropriate workload of a MOOC is part of internal politics of a HEI, but there is one more financial aspect that need to be taken in consideration, except others like those of technical nature.

Designing a MOOC has its challenges. It requires time and commitment. The most is the fact that MOOCs are often lecture based. Lecture-based pedagogy is the most traditional form of pedagogy, where the teacher delivers lecturers on the

subject matter to the students, and students takes notes and ask questions. The instructor presents information to students in a one-way communication. This pedagogy is often used in larger classrooms, where interaction with students is limited. Number of participants, which easily for high-ranked HEIs exceed to thousands, is a challenge. Of course, technology is very advanced and the objective is that every student of a MOOC can become generator of the content, but this factor has a strong connection with the motivation. From the other side, experience and lesson learned are key factors. So, continuing with the challenges, based on our MAGNET Project, there is a list of course elements that needs to be part of the presentation of the course in the website, such as the title, a short description, course overview, number of courses offered, class start & end dates, estimated effort, prerequisites or enrolment profile, course staff bio, course language, the need of a textbook or no, etc.

But there is one more element that needs to be state from the very first, based on our project MAGNET and Albanian case: Does after successful completion of the course, the student will receive a certificate or diploma? If yes, this course should have an accreditation by the Ministry of Education and Sports, while we don't have any regulation regarding this kind of teaching and learning.

In the case of Italy, one of the platforms that provides MOOCs, "Federica Web Learning", has started as a project co-financed by the "European Union", the Italian government and the "Campania Regione", with the name "La Fabbrica Digitale", from 2014 year. A partnership of Albanian Higher Education Institutions with this platform and/or others will make those challenges easier and Albanian educational landscape more qualitative and more attractive.

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