



BPU11 Congress, Belgrade, September 2022

Physics Education Roundtable

**Challenges in studying physics in higher education –
Specificities in Balkan Countries.**

Mădălin BUNOIU

West University of Timișoara, Romania



Outline – A few key points

- What do the curricula look like?
 - autonomy in establishing subjects, hours per week;
- How the National Quality Assurance Agencies or other national organisms / institutions controls a study program's organization;
 - What should the level of standardization in activities across a country (or even Europe) be? Example: the evaluation process...
 - How many different programs per domain & level are sustainable?
- Language of instruction: national language or towards Masters/ Bachelor Studies in English?
 - Sofia University has a *Nuclear and Particle Physics* Bachelor program;
 - Bucharest University has a *Physics* Bachelor program.
- Undergraduate + graduate studies: Bologna (3+2 – case of Romania, or 4+1 – case of Bulgaria/Serbia) vs. 5 years programs:
- Teacher of physics profession
 - Didactical Master / “Master of Education”

*Varying
structures of
study
programs in
the Balkans –
and how are
they
organized*

Outline – A few key points

- Who are the (prospective) physics students, and which are their characteristics?
 - men/women ratio; migrants/mobility students,...
- What increases / decreases the attractiveness towards physics in general?
- How to test prospective students' level of knowledge in physics in a relevant way?

- How to best integrate digital learning technologies in Physics Higher Education?
- At which level should various types of technologies be introduced, and who introduces them?
- Has there been a transition towards online / hybrid teaching and in what proportion is this beneficial?

A program should be tailored to the target-group and its interests

Digital learning and use of technology in teaching is pervasive and inevitable

What is
changing and
what
remains the
same?

“Between 2006 and 2015 no major changes occurred in European students’ career orientations towards STEM. The share of 15-year-olds considering such an occupation increased only marginally and rather unevenly across the Member States, while gender segregation remained deep, showing a tendency to persist across European countries.”

[Blasko Z., Propkopec A., Sikora J., Science career plan of adolescents: patterns, trends and gender divides, Joint Research Center Science Hub, European Comission, 2018, https://publications.jrc.ec.europa.eu/repository/handle/JRC109135](https://publications.jrc.ec.europa.eu/repository/handle/JRC109135)

Migration for education and Mobilities

*“Migrants show a **greater interest in science careers** than other students who are comparable with respect to science performance, attitudes, and parental cultural and socio-economic background. We also find that the greater interest in STEM in migrant populations comes mostly from males.”*

[Blasko Z., Propkopec A., Sikora J., Science career plan of adolescents: patterns, trends and gender divides, Joint Research Center Science Hub, European Comission, 2018, https://publications.jrc.ec.europa.eu/repository/handle/JRC109135](https://publications.jrc.ec.europa.eu/repository/handle/JRC109135)

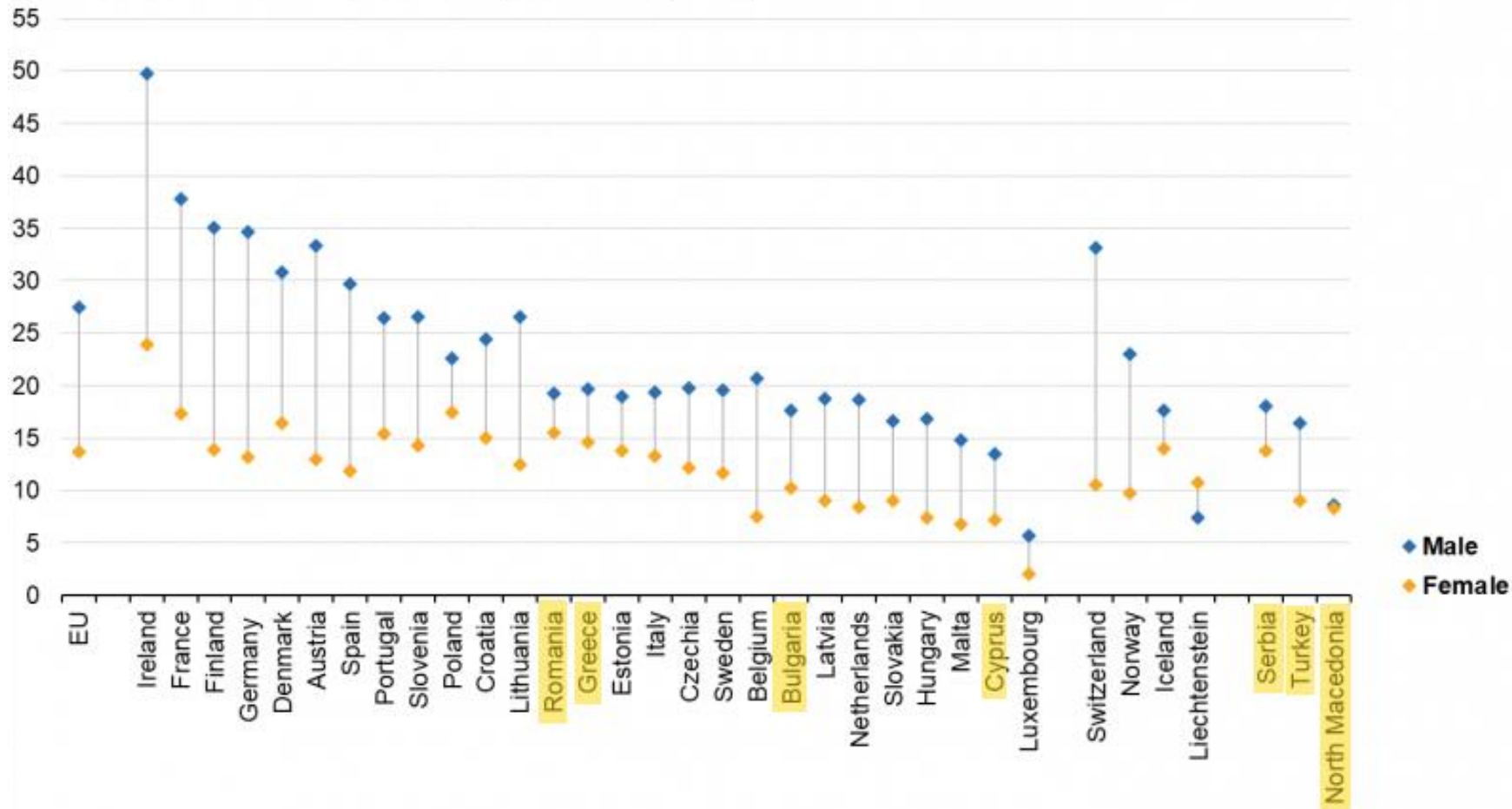
Proactive
attitude
towards
Mobilities
and Access
for all

*“[...] the **need** for public authorities and higher education institutions to **ensure equal access** for all students to all learning opportunities offered by **mobility programs**. This means that institutions need to address difficulties or impediments that might hinder or even completely prevent access to mobility programs especially for students from vulnerable, disadvantaged or underrepresented groups.”*

European Commission, European Education and Culture Executive Agency, Towards equity and inclusion in higher education in Europe, Publications Office of the European Union, 2022, <https://data.europa.eu/doi/10.2797/631280>

Tertiary education graduates in natural sciences, mathematics and statistics, information and communication technologies, engineering, manufacturing and construction, by sex, 2019

(number per 1 000 inhabitants aged 20-29 years)



Note: ranked on the ratio for both sexes combined.

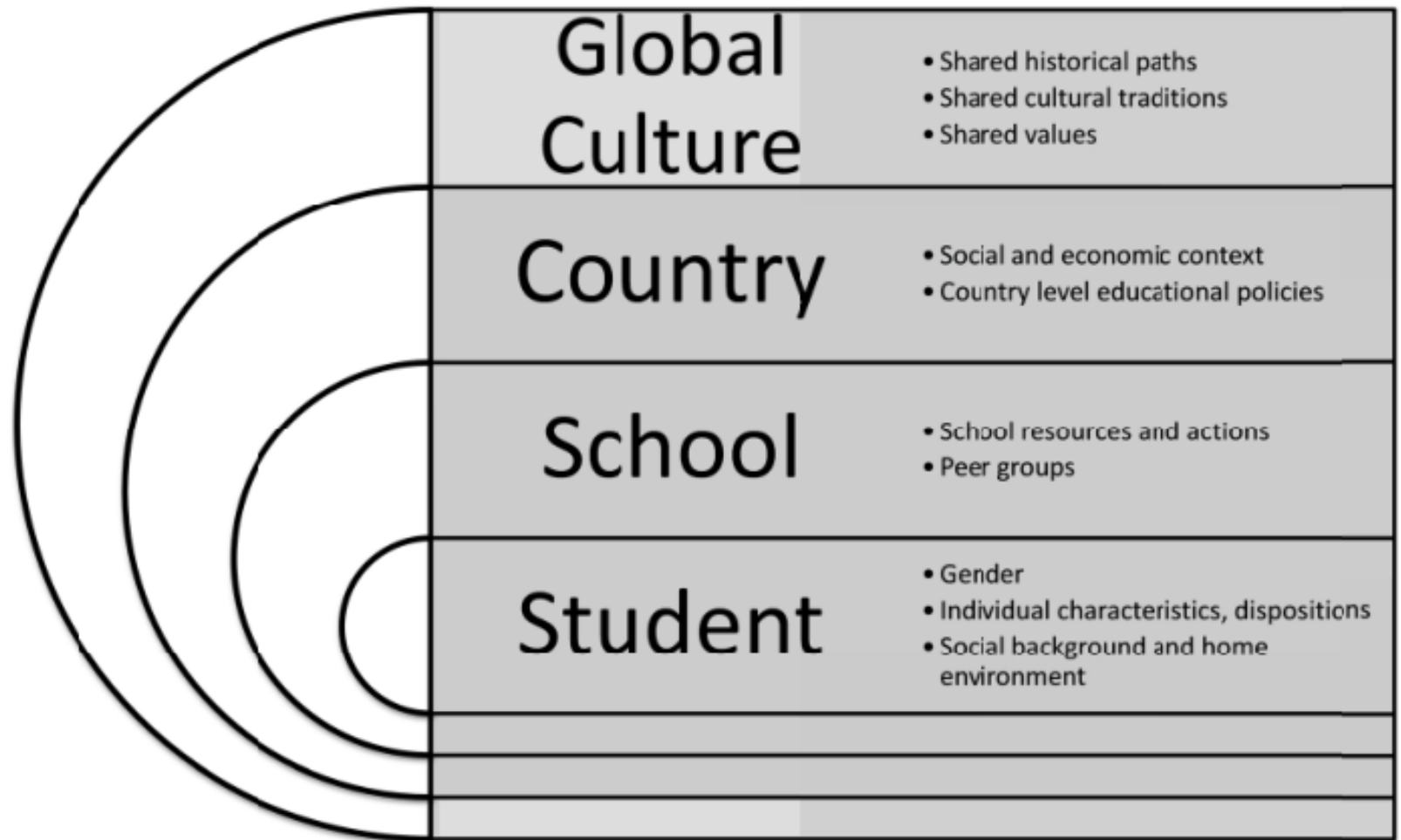
(¹) Excluding graduates of vocational academies.

Source: Eurostat (online data code: educ_uoe_grad04)



[https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Tertiary education graduates in STEM, by sex, 2019 \(number per 1 000 inhabitants aged 20-29 years\).png](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Tertiary_education_graduates_in_STEM,_by_sex,_2019_(number_per_1_000_inhabitants_aged_20-29_years).png)

At which level
can we act to
stimulate the
interest in
Physics / STEM
Education?



Does
standardization
stifle creativity
in Sciences?

*“**Standardisation** of outputs, on the other hand, was shown to be systematically and **negatively related to interest in general science careers** among 15-year-old students. In particular, students were less likely to opt for an occupation in mathematics, physical and life science, engineering, or computing in countries where **standardised examination** in science takes place.”*

A need for
standardized
testing in
physics/
science?

*“[...] national tests and **certified examinations** are more commonly **organized in mathematics than in science**, especially when it comes to tests that are **compulsory** for all students. This is also true of national tests that aim to identify individual learning needs .”*

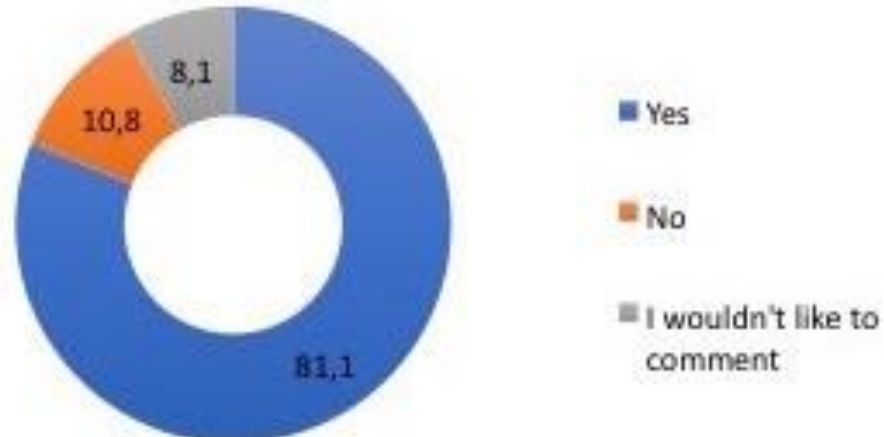
European Commission, European Education and Culture Executive Agency, Increasing achievement and motivation in mathematics and science learning in schools, Publications Office of the European Union, 2022, <https://data.europa.eu/doi/10.2797/031821>

How (exactly)
is digital
literacy
integrated in
physics/
science
curricula?

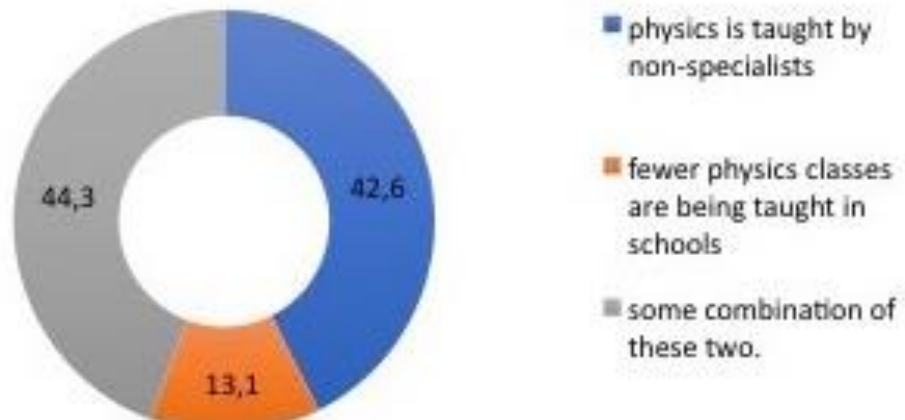
- as a **cross-curricular theme** (Digital competences are transversal and therefore taught across all subjects in the curriculum and **all teachers share the responsibility** for developing)
 - a **separate subject** (Digital competences are taught as a **discrete subject area** similar to other traditional subject-based competences)
- **integrated in other subjects** (Digital competences are **incorporated into** the curricula of other subjects or learning areas - e.g. mathematics, science, languages and arts)

European Commission, European Education and Culture Executive Agency, Increasing achievement and motivation in mathematics and science learning in schools, Publications Office of the European Union, 2022, <https://data.europa.eu/doi/10.2797/031821>

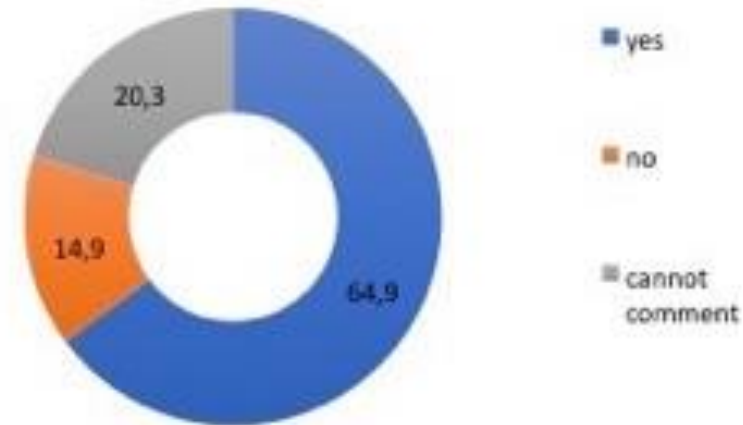
Do you believe there to be a shortage of specialist physics teachers?



What in your experience are the consequences of this shortage?



Do you think the quality of some students entering university in your country has been affected by the shortage of specialist teachers?



Is there (still) a shortage of Higher Education Teaching Personnel?

EU STEM Coalition

- The EU STEM Coalition is an EU-wide network that works to build better STEM (Science, Technology, Engineering, Mathematics) education in Europe. Its goal is to shape STEM education policies and practices that foster economic growth, opportunity and well-being for all.



- The EU STEM Coalition has been included or referenced in various EU agendas and strategies. The EU STEM Coalition has also received financial support through EU-funded projects.

*How to
collectively
build a
better
Physics/
STEM
education?*

EUPEN Partners Sought

As reported in *Europhysics News* 26 (1995) 69, the Scientific Committee of the Thematic Evaluation Conference - *Physics Studies for Tomorrow's Europe* (Ghent, 7-8 April 1995) decided to create a European Physics Education Network (EUPEN). A Steering Committee was formed and it has prepared an outline proposal for a Thematic Network in the framework of the SOCRATES programme of the European Union (EU). It will be submitted to the European Commission before 1 March 1996. Organizations throughout Europe,

European Physics Education Networks

- The academic network *Horizons of Physics Education* [HOPE] was launched in October 2013. The three-year project is supported by the Life Long Learning Programme of the European Union. It was *the 6th thematic network* in physics education in a series of networks beginning in 1995 with European Physics Education Network [EUPEN].
- **HOPE** is the de facto successor to **EUPEN** (established 1995) and the subsequent Stake Holders Tune European Physics Studies [**STEPS**] (2005-08) and **STEPS TWO** (2008-11) projects.

When did it all start?

Is there still 'hope'?



European Physical Society

more than ideas

- The European Physical Society is a non-profit organisation whose purpose is to **promote physics and physicists** in Europe through methods such as physics outreach.
- Formally established in **1968**, it is the largest organisation that has *continuously contributed significantly to European physics in education, research and student mobility, publication and outreach.*
- The EPS has Member Societies in **42 European countries**. EPS Member Societies **represent over 120,000 physicists** and coordinate activities on a national level.

*EPS – the
largest
european
organisation
for physics
and
physicists*

Opportunities for student and academic staff/researchers exchanges:

- ERASMUS+ traditional student and staff mobilities (Key Action 131 Programme Countries, Key Action 171 Partner Countries), as well as other Erasmus+ Key Actions dedicated to cooperation in higher education (Capacity Building, Strategic Partnerships etc):
<https://erasmus-plus.ec.europa.eu>
- - CEEPUS (Central European Exchange Program for University Studies): <https://www.ceepus.info>
- - Other research and higher education cooperation programmes (cross-border, for example).

*Mobilities
for
students
and
academic
staff*

UVT Partnerships in the (geographical) Balkans: Erasmus or Memorandum of Understanding



Albania

Aleksander Moisiu University of Durrës
University of Elbasan "Aleksander Xhuvan"
University of Tirana
European University of Tirana UET
University College "Bedër"
Metropolitan Tirana University
ShLuj Universiteti Marin Barleti
University of Vlora "Ismail Qemali"



Bulgaria

South-West University "Neofit Rilski"
Higher School of Security and Economics
Plovdivski Universitet "Paisii Hilendarski"
New Bulgarian University
University of National and World Economy
Sofia University St.Kliment Ohridski
National Academy of Music "Prof.Pancho Vladigerov" Sofia
University of Economics-Varna
University of Veliko Turnovo
Vasil Levski National Military University



Montenegro

University of Montenegro, Faculty of
Economics
University Mediterranean



Serbia

University of Belgrade
Megatrend University
Faculty of Business and
Entrepreneurship
University of Kragujevac
University of Niš
University of Novi Sad
Mining and Metallurgy Institute Bor
Nikola Tesla University



Bosnia and Herzegovina

University of Banja Luka
University of East Sarajevo
University of Mostar
International Burch University
International University of Sarajevo (IUS)
University of Tuzla



North Macedonia

"St Kliment Ohridski" University
University of Information Science and
Technology "Saint Paul the Apostle" Ohrid
SS.Cyril and Methodius University in Skopje
International Slavic University "Gavrilo
Romanovich Derzhavin"
Goce Delcev University
State University of Tetova
South East European University

Thank you!

