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EASA Expert Group: Education, Research, Innovation (ERI) Policy paper on ERI

Coordinator: Prof. Ioannis Liritzis (Dean Class IV)

Compilation input:

Prof. Andrew Balas (Class II); Prof. Thomas Beyer (Class II); Prof. Costas Demetzos (Class IV); Prof. Igor Emri (Class VI); Prof. Gilles Lubineau (Class V)

Members of the Expert Group:

Prof. Dr. Stefan Brunnhuber (Class II); Prof. Dr. Miklós Bendzsel (Class V); Prof. Tiziana Catarci (Class IV); Prof. Dr. Dr. Ulrich Hemel (Class VII); Prof. Werner G Faix (Class V); Prof. Kristof Fenyvesi (Class III); Prof. Dr. Klaus Mainzer (Class I); Prof. Lucas Rasulic (Class II); Prof. Peng Shi (Class IV); Professor John S. Torday (Class II); Prof. Miroslav Veskovic (Class IV)

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1.1 RECOMMENDATIONS FOR ACTION

1) **New teaching models should integrate various digital tools especially (effective use of publicly available digital information, distance learning, virtual reality, STEM-focused curricula) to develop problem-solving skills and encourage innovation**.

2) Education should become more interesting, more engaging, and closer to real life. We need to teach the skills of accurately expressing problems, phenomena, opportunities, and solutions.

3) At the earliest level of education, interdisciplinary and transdisciplinary interactions and collaborations should be promoted. Such collaboration should stem from the balance of humanities and natural sciences & technology. All students should be exposed to collaboration with students from different disciplines and different levels of education (i.e., undergraduate, graduate, doctoral).

4) The research, innovation and educational combined should be used for the society benefit by using new digital communication tools.

5) Tuned with the European Horizon 2021-2027, EASA's aim is to strengthen science and technology in the European Union, by investing in education; advancing, however, novel approaches as white papers and if feasible implement those in synergy with educational and research establishments.

6) The three pillars of Horizon Europe, meaning *1. Excellent Science, 2. Global Challenges and European Industrial Competitiveness and 3. Innovative Europe* should be taken into consideration and should be clarified. For EASA, Education should be the platform for increasing community involvement in this new era of a European and global transition to the digital world.

7) We need more clarification about the interdisciplinary scope of Education, Research, Innovation (ERI) as methodology and applications in the different classes and disciplines of our Academy which supports new cooperation and transdisciplinary innovation.

Therefore, besides concrete technologies, the importance of prioritizing R&I as norms should be coupled to the future Education and towards a global certificate.[1]

8) Besides established IT tools, new promising technologies should be developed and applied to enhance Europe's position in a worldwide competition of innovation and Education; an education which should include the experiencing dimension- in the class, in the field, and in the virtual educational environment. New technologies are needed to make possible remote, global and large-scale teaching in experimental sciences where practice is an important part of the learning objectives.

9) Our Academy should concentrate the expertise of its members in the research on intelligent systems and machine learning, in new instrumentation and research questions which tie with innovation but finally education, to sharpen the profile of the Academy.

10) Finally, R&I should aim at sustainable innovation and service systems for education and LLL in society.

The purpose of this preliminary policy paper is to introduce the conception and development of a new educational structure and mode concerning a new model for a ERI model which could lead to a "European Degree" of accredited and evident capabilities that is designed to fill a gap in worldwide higher education. By definition, this new standard would result in a new higher education institutional paradigm.

The ERI Towards a new didactic model

The ERI must develop a new didactic model to focus on the following learning dynamics:

- *The utilization of new technologies in higher education.*
- *The need for continuing education and lifelong learning.*
- *Active participation of students and self-learning process*
- *Development of interdisciplinarity in the three categories of natural sciences, arts & humanities, life sciences*
- *Modeling the transdisciplinary with examples*

The **interdisciplinary** scope of Education, Research, Innovation (ERI) as methodology and applications in the different classes and disciplines surely supports new cooperation and transdisciplinary innovation. Much as the ongoing interdisciplinary Colloquia, EASA should investigate ways of making a new model possible.

The different levels and disciplines could be reformed for the three broad scientific categories of *natural sciences, arts & humanities, life sciences*, applying a smoothly increased and broad spectrum of difficulty chapters. The teaching of pupils or LLL for a human style of life balanced between, human relations, principles and values (development of virtues) in a practical sense, and technological / economic growth. Thus, fundamental principles of philosophy for a round knowledge person and cultural progress based on human rights, values, cooperation, but human autonomy too, in the exploration of the micro-and macro-environment we live or sense, should become an inseparable entity to every educational stage. After all, these concepts are in the best of European philosophical and educational traditions, as well as with the leading values of the European Academy.

Here a new concept of interaction and interdisciplinarity should emerge. The indispensable condition would be an experiencing style training with hands-on and contact with the subject. The transition of educational to the Digital word raises new challenges as experimental sciences are intrinsically challenging to experience online and via remote learning. The digital (VR etc)

[1]https://www.un.org/en/un-chronicle/global-degree-proposal-new-institutional-model-higher-education

component is a first preparatory stimulus stage to trigger the interest (for earth / environmental sciences, biological, landscapes, sophisticated instrumentations, space environment), but a step still need to be invented about how to transform this initial stimulus into a pratical high-quality education providing skills applicable on real-life problems. The digital presentation suffices for the lack of costly infrastructures.

Indeed, the economics, infrastructures, innovative models should balance the various tools used especially digital (distance learning, virtual reality in education, STEM, STEAM-STEM in Arts, STEMAC-STEM in Arts & Culture etc.) to achieve a more sustainable world in these three axes.

We underscore the importance of well-rounded higher education that includes humanities as well as basic STEM skills in every profession. A particular danger is the accelerating loss of exposure to humanities in technically oriented higher education, like engineering, biology or medicine. We need to reverse this trend before further damaging our society and our professionals.

New promising technologies in every research direction should be developed and applied to enhance Europe's position in a worldwide competition of innovation and Education; an education that should include the experiencing dimension- in the class, in the field, and in the virtual educational environment.

The advantage of digital gaming based on serious games of science coupled with humanities becomes exuberant and there the unforceful inclination of learners to a particular discipline of knowledge emerges. As Plato said "*do not use compulsion, but let early education be a sort of amusement; you will then be better able to find out the natural bent*"[2]

Examples include:

1. research and innovation in the field of health. The Pandemic and the virus SARS-CoV-2 have changed the research direction into more genetic approaches based on bio and nanotechnologies. We can organize proposals for the development of new tools and guidelines, for a future pandemic.

2. Research and innovation in the field of climate change

3. Research and innovation in the field of energy

Education/ training of experts in the contemporary fields and guidelines for the society could be our educational contribution and act as an umbrella in all these.

New Technologies Boosting Modern Education

Today, it is widely acknowledged that the educational landscape is shifting. There are more options than ever for studying, including traditional, part-time, full-time, distance, and online options. Global developments, on the other hand, need the reorientation of existing educational systems as well as the construction of new ones to prepare students for new demands. People wish to learn in a variety of methods that suit their needs and preferences; it is critical that we answer this need by providing learners with exactly what they want, when they want it. Along this pragmatism today the research work and innovation should be coupled with the Education. New opportunities emerge for research work and moreover for springing from research the innovation spirit.

Modern education has to cover a much broader variety of topics compared to a few decades ago. Solving contemporary world challenges in environment, climate and health requires training experts in two or more core scientific fields, as well as in the connectivity between these. This "education at the interface" is one of the biggest challenges of the 21st-century academics.

First, that requires students, engineers, and scholars at large to span over a much larger body of information. We easily understand that the immediate risk is superficial and non-qualifying training. We have already seen in the past decade the proliferation of schools promoting training of engineers with very "generic" profiles, and compromising on the core scientific competency. The immediate result of such a choice would be a generation of engineers unable to design advanced

[2] Plato, The Republic, 7. BOOK VII, trans. Benjamin Jowett (Minneapolis, Minnesota, First Avenue Editions, 2015), 186.

products and systems. Such systems should be the cornerstone of the European economy and cannot be designed without a deep mastering of each scientific field.

Second, this recent need for multidisciplinary education comes exactly at the time of increasing digitalization. Digital education is at the same time a risk and a chance to achieve the goal of "diversity with expertise".

A risk, because in many fields requiring hands-off experience on physical systems, it results in a lack of qualification that can be obtained so far only by lengthy and costly training in face-to-face instruction A deep reflection has then to be made about the way digital education, remote learning, and massive online education, can evolve and introduce new tools, enabling this hands-on experience to happen in a new manner. New interfaces, not only based on video and sounds, but also on tactile, olfactive and gustative experiences need to be developed or are already under development.

A chance, because this "diversity with expertise" will require the design of new degrees in which experts for many different fields should serve as instructors. Digital education is actually a path here to preserve quality, by allowing bringing international experts from all fields in unique degree tracks for the best of our students.

The mastering of knowledge (theoretical and instrumental) shall be much more effective and efficient, than now, with the start to boost digital applications to these three broad categories and their existing trans-category emerging disciplines (examples for such new cooperation and transdisciplinary innovation: physical sciences with biological processes, medicine and physical sciences, environmental sciences & cultural heritage, poetry/literature/music vs. respective natural sciences processes, human (social) relations tuned with physical laws in nature. Through the interdisciplinarity making extensive use of digital technology the spirit of research and innovation can be developed as one educational system.

Beyond concrete technologies, the importance of prioritizing R&I as norms to be taken into account for the future Education and a global certificate.

REFERENCES

Research and innovation strategy 2020-2024, https://ec.europa.eu/info/research-and-innovation/strategy/strategy-2020-2024_en

European Commission, Directorate-General for Research and Innovation, Rosa, A., Giesecke, S., Schaper-Rinkel, P., et al., Transitions on the Horizon : perspectives for the European Union's future research and innovation policies, Publications Office, 2018, https://data.europa.eu/doi/10.2777/493572

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS A new ERA for Research and Innovation, COM/2020/628 final

Horizon Europe, Research and innovation funding programme until 2027, https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe_en

Paunov, C. and S. Planes-Satorra (2021), "What future for science, technology and innovation after COVID-19?", OECD Science, Technology and Industry Policy Papers, No. 107, OECD Publishing, Paris, https://doi.org/10.1787/de9eb127-en.

REIMAGINING OUR FUTURES TOGETHER A new social contract for education, REPORT FROM THE INTERNATIONAL COMMISSION ON THE FUTURES OF EDUCATION, https://unesdoc.unesco.org/search/N-EXPLORE-4531665c-601d-4695-8350-71edd6270fb7

Robert Tijssen, John Edwards and Koen Jonkers, "Regional Innovation Impact of Universities" 14 May 2021, ISBN: 9781839100529 eISBN: 9781839100536, DOI: https://doi.org/10.4337/9781839100536

Kaputa V., Loučanová E., Tejerina-Gaite F.A. (2022) Digital Transformation in Higher Education Institutions as a Driver of Social Oriented Innovations. In: Păunescu C., Lepik KL., Spencer N. (eds) Social Innovation in Higher Education. Innovation, Technology, and Knowledge Management. Springer, Cham. https://doi.org/10.1007/978-3-030-84044-0_4

The Future of Digital and Online Learning in Higher Education, Reflection Paper Series, Publications written/published by external organisations at the request and with the support of the European Commission. Written by Stefan Humpl (3s), Tine Andersen (DTI), PDF ISBN 978-92-76-40148-3 ISSN 2600-321X doi: 10.2766/587756 NC-BC-21-004-EN-N © European Union, 2022

Barbazzeni B and Friebe M (2021) Digital Scientist 2035—An Outlook on Innovation and Education. Front. Comput. Sci. 3:710972. doi: 10.3389/fcomp.2021.710972

Liritzis, I (2018) STEMAC (science, technology, engineering, mathematics for arts & culture): the emergence of a new pedagogical discipline. SCIENTIFIC CULTURE, Vol. 4, No. 2, pp. 73-76 DOI: 10.5281/zenodo.1214567

Nienke van Atteveldt, Geertje Tijsma, Tieme Janssen,Frank Kupper (2019) Responsible Research and Innovation as a Novel Approach to Guide Educational Impact of Mind, Brain, and Education Research, Mind, Brain, and Education 2019 279-287, https://doi.org/10.1111/mbe.12213,

Bart Rienties, Regine Hampel, Eileen Scanlon, Denise Whitelock (editors) (2022) Open World Learning Research, Innovation and the Challenges of High-Quality Education, Routledge

V. Lynn Meek, Ulrich Teichler, Mary-Louise Kearney (Editors) (2009) Higher Education, Research and Innovation: Changing Dynamics Report on the UNESCO Forum on Higher Education, Research and Knowledge 2001-2009, International Centre for Higher Education Research Kassel (INCHER-Kassel), Univ. of Kassel

https://observatory.tec.mx/edu-news/ethna-system-rri,

https://www.oecd-ilibrary.org/education/innovating-education-and-educating-for-innovation_9789264265097-en