September 2022

ALLEA STATEMENT IN RESPONSE TO THE EUROPEAN COMMISSION'S CALL FOR EVIDENCE ON DIGITAL EDUCATION AND DIGITAL SKILLS

The European Federation of Academies of Sciences and Humanities (ALLEA) is committed to supporting the advancement of STEM (Science, Technology, Engineering, and Mathematics) education throughout Europe to equip young students with the skills and knowledge to develop into active and informed citizens. The ALLEA Working Group on Science Education therefore welcomes the opportunity to share its recommendations on the European Commission's initiatives for *"Digital education – enabling factors for success"* and *"Digital skills – improving their provision".*[1]

We assume that both initiatives will be carried forward concurrently in the context of the European Union's Digital Education Action Plan (2021-2027)[2] in order that the highest level of acceptance and coherent implementation is achieved amongst national governments, schools, and teachers. In our recommendations, therefore, we refer to both initiatives simultaneously.

The aim of both initiatives is to build support for stakeholders in European countries to further develop the field of digital education and training in all age groups and institutions. In order for the proposed actions to be implemented most effectively, we recommend that a **systemic approach** is needed that addresses teaching and learning at different levels: policy, research, curriculum design, teacher education, and practice. In addition, we propose that a greater emphasis be placed on interdisciplinarity, the integrated nature of digital technologies within STEM education, and the critical roles of empirical educational research, initial teacher education (ITE) and teachers' professional learning (TPL). We illustrate our arguments with a subject that will have significant impact in the field of digital education in the coming years — Artificial Intelligence (AI).[3]

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1   https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13207-Digital-education-ena-bling-factors-for-success_en and https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13208-Digi-tal-skills-improving-their-provision_en

2   https://education.ec.europa.eu/focus-topics/digital-education/action-plan

3   UNESCO "AI and Education: guidance for policymakers" (2021): https://unesdoc.unesco.org/ark:/48223/pf0000376709

Interdisciplinarity

Various actions in both initiatives focus on the important goal of closing digital gaps and making high-quality and inclusive education widely available, independent of age, ethnicity, gender/sexuality, religion, geography, or socioeconomic background. What remains unclear is which disciplinary perspectives need to come together to reach these goals, as this task cannot simply be taken on by computer science alone. What is needed are interdisciplinary expert groups that reflect on the technical, educational, social, and ethical issues in relation to digital education, and that can advise on political, administrative, and curricular decisions in a coherent manner. Which educational goals should be targeted at which age level and as part of which school subject? For example, in relation to AI, interests and viewpoints must be carefully balanced between different disciplines that contribute to digital education. The European Commission is in a unique position to make a positive contribution here by stimulating Europe-wide cooperation and exchange of best practices. Existing national coordinating bodies for the development and pedagogically adaptive use of digital technologies, including AI, should be used as guiding examples to inform the development of a European equivalent and employed for focused interdisciplinary innovation efforts.

Evidence-based reforms

Some of the proposed actions emphasise the need for stronger dialogue between different stakeholders, especially between the public and private sector. However, another component that needs to be considered more explicitly is the role of research that provides empirical evidence on education innovation. The quality of innovation in education does not depend on whether the interests of stakeholders come together, but on whether decisions stand up to critical empirical inquiry. Every decision about a technical or structural development in digital education must be tested against the latest scientific evidence in relation to teaching and learning, including curricula, pedagogies, ITE and TPL. If educational administrators and industry develop joint activities or programmes, such as AI-supported teaching-learning systems, it should be demonstrated that the desired outcomes are supported by robust scientific evidence. At present, the quality of new technological developments, as well as the accompanying empirical research, still need to be assessed against more critical standards drawn from the knowledge base of decades of research in (STEM) education.
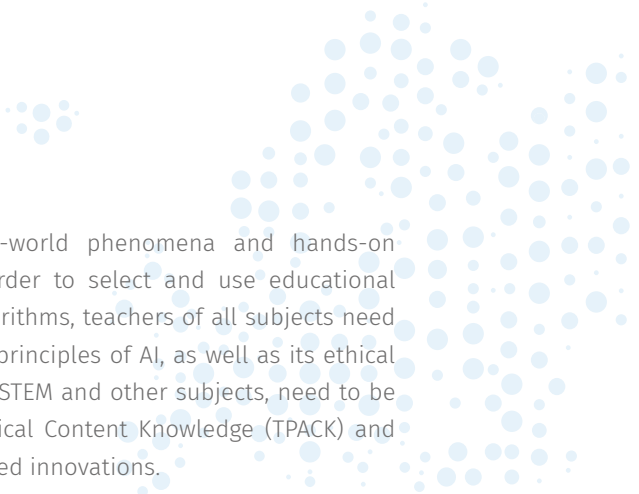
Initial teacher education and teachers' professional learning

Several actions from the initiatives refer to the education and recruitment of teachers. However, in our view, too little emphasis is currently being placed on the roles of ITE and TPL. A coherent picture of digitalisation-related teacher professionalism is critical to all efforts of systematic development in educational institutions. For this, one can draw on a substantial body of research, such as the 2017 *European Framework for the Digital Competence of Educators: DigCompEdu*.[4] The need for TPL is also illustrated by the example of AI: any teaching-learning systems, including future AI-supported ones, are much more effective if they are directly integrated into subject teaching.[5] Especially in STEM education,

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4   https://publications.jrc.ec.europa.eu/repository/handle/JRC107466

5   Hillmayr, Delia; Ziernwald, Lisa; Reinhold, Frank; Hofer, Sarah Isabelle; Reiss, Kristina M. (2020). The potential of digital tools to enhance mathematics and science learning in secondary schools: A context-specific meta-analysis. Computers & Education, Vol. 153, 103897: pp. 1-25. https://doi.org/10.1016/j.compedu.2020.103897

digital learning should be combined with experiencing real-world phenomena and hands-on investigations during all educational stages. Furthermore, in order to select and use educational software appropriately, and to assess the range and limits of algorithms, teachers of all subjects need to be supported in acquiring foundational knowledge about the principles of AI, as well as its ethical use. Likewise, teachers not only of computer science, but also of STEM and other subjects, need to be supported so they develop the requisite Technological Pedagogical Content Knowledge (TPACK) and skills needed to critically evaluate and implement technology-based innovations.

In all three areas discussed above, the planned initiatives can, and should, support national governments and teachers by identifying positive examples from the very heterogeneous European educational landscape to develop a research-based roadmap towards a technology-driven educational landscape.

About ALLEA

ALLEA is the European Federation of Academies of Sciences and Humanities, representing more than 50 academies from over 40 countries in Europe. Since its foundation in 1994, ALLEA speaks out on behalf of its members on the European and international stages, promotes science as a global public good, and facilitates scientific collaboration across borders and disciplines.

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About this Statement

This ALLEA Statement has been prepared by ALLEA's Working Group on Science Education with Prof Timo Leuders as principal author. Through its Working and Expert Groups, ALLEA provides input on behalf of European academies to pressing societal, scientific and science-policy debates and their underlying legislations. With its work, ALLEA seeks to ensure that science and research in Europe can excel and serve the interests of society.

Learn more about the ALLEA Working Group on Science Education: https://allea.org/science-education/