International Dialogue on STEM DEVELOPING A VISION FOR EARLY EDUCATION

“Early STEM Education in the Digital Age”

White Paper Summary, November 2024

The white paper “Early STEM Education in the Digital Age” sheds light on the discourse surrounding the integration of digital tools in early STEM Education and discusses the benefits and risks of this approach to promoting digital skills from kindergarten onwards. It shares research along with practical evidence from the International Dialogue on STEM Education (IDoS), a network promoting early STEM Education globally.

Why this topic, why now?

The ongoing debate on digital media use in early STEM Education – with conflicting theories, myths, and polarised opinions – has made it increasingly challenging for educators and decision-makers to make informed, evidence-based choices on whether and how to integrate these technologies.

The paper provides recommendations for implementing and advancing early STEM Education in the digital age and includes examples from the different organisations involved in this effort. It is aimed at educational organisations, policymakers at national and international levels, and professionals interested in STEM Education.

Part 1: Research

The findings in the first chapter emphasise the importance of integrating technology into STEM Education to enhance students' critical thinking, problem-solving, and reasoning skills. The effectiveness of digital tools in education is not straightforward, as it depends on how they are used. Certain technologies, like simulations and scaffolding tools, are particularly effective for subjects like maths and science. However, educational products must align with the learner's cognitive development, especially as attention and focus evolve with age.

Technology should complement, not replace, traditional learning methods, and teaching principles must remain central to effective education, regardless of the tools used. Educators should avoid polarised debates about technology and instead rely on insights from cognitive science – such as how attention, memory, and learning mechanisms work – to guide their teaching strategies.

Developing computational literacy is crucial in today’s digital world. It equips individuals with the skills needed to engage meaningfully in society and shape a future where technology benefits the common good.

IDoS is an initiative of:

Stiftung Kinder forschen – MINT-Bildung für nachhaltige Entwicklung

SIEMENS Stiftung

Funded by:

SIEMENS Stiftung

WILHELM UND ELSE HERAEUS-STIFTUNG

Under the patronage of:

OECD

By applying advances in cognitive science, educators and organisations like IDoS can make informed decisions about integrating technology into STEM Education, ensuring it fosters both individual development and societal progress.

Part 2: Recommendations

Based on the theoretical findings and scientific evidence of part 1 the authors propose a set of six recommendations for STEM Education in the digital age. Each IDoS peer underlines these recommendations with first-hand examples of their organisation's projects and programmes around the effective integration of digital tools in everyday STEM-learning in kindergartens and primary schools.

1. **Integrate technology with purpose: justify digital tools based on clear learning objectives in STEM Education.**
2. **Prioritise pedagogy: effective teaching methods must drive technology use in STEM – not vice versa.**
3. **Enhance, don't replace: use digital tools to complement real-world STEM learning.**
4. **Prepare for success: invest in teacher training and infrastructure for effective digital integration that benefits all.**
5. **Empower digital literacy: transform STEM Education to navigate a rapidly changing world.**
6. **Use evidence-based practices: leverage research to enhance STEM Education and effective teacher training.**

Part 3: Examples

The final part of the paper presents the IDoS peers' actions for promoting STEM Education in the digital age. It sheds light on each organisation's stance on digital tools and provides examples of how technologies are used in the classroom, for teacher trainings, and with pre-school children and their families. The peers also reflect on the impact the Covid-19-Pandemic had on the digitalisation of their pedagogical offers.

See here some of the projects and offers showcased by the peers:

Fondation La main à la pâte (France)	→ FizziQ measurement tool
LUMA Centre Finland (Finland)	→ ViLLE learning platform
Office for Climate Education (France)	→ The Greenhouse Effect
Siemens Stiftung (Germany)	→ Algorithms in our everyday lives
Smithsonian Science Education Center (USA)	→ A Weighty Problem
Stiftung Kinder forschen (Germany)	→ Digital Detectives

For further examples please refer to the full version of the white paper.

Pasquinelli, E., Borde, B., Dhar, J., Filtzinger, B., Franz, F., Henke, N., Lundell, J., Oberthür, J., O'Donnell, C., Pahnke, J., Sadadou, D. (2024). Early STEM Education in the Digital Age. Berlin, Germany: International Dialogue on STEM Education.

About the International Dialogue on STEM Education (IDoS)

The International Dialogue on STEM Education (IDoS) is led by six organisations worldwide, whose members – the "IDoS peers" – are experts in the field of early STEM Education. As such, they each learn from one another through regular exchange to implement their work at home more efficiently, more effectively, and in a more knowledge-based way.

The "International Dialogue on STEM Education" (IDoS) is a joint initiative of Stiftung Kinder forschen (Little Scientists Foundation) and Siemens Stiftung. IDoS is funded by Siemens Stiftung and the Wilhelm und Else Heraeus Foundation. Under the patronage of the OECD.

The IDoS peers represented in this paper are: