



EUROPEAN POLICYBRIEF

STEAM FOR THE FUTURE



In this policy brief, we push the envelope of the European Union' *STEM Education Strategic Plan*, suggesting how approaches grounded in STEAM education could strengthen its implementation and increase its impact.

August 2025

INTRODUCTION

The Road-STEAMer project's main aim is to develop a [STE\(A\)M roadmap for science education in Europe](#), that is, a plan of action to provide guidance to the EU's key funding programmes for research and innovation on how to mainstream educational approaches that go beyond traditionally defined STEM, incorporating artistic and creative perspectives. With this in mind, the Road-STEAMer consortium welcomes the release of the **STEM Education Strategic Plan (STEM-ESP)**¹, which aims to address the current skills shortages and mismatches by focusing on STEM as a strategic pillar in the EU skills policy, build a stronger and more inclusive talent pipeline, and overcome gender disparities in this field. The inclusion of the STEM-ESP in the programme of the first 100 days of the EU Commission 2024-2029 is of particular significance, as it clearly signals unprecedented commitment to improving educational outcomes across the EU. Several of the initiatives included in the three pillars of the STEM-ESP (*LEAD: Anchor STEM as a strategic pillar in the EU's education and skills policy; LEVEL up: Build a stronger and more inclusive EU STEM talent pipeline; LIFT barriers: Advance women in STEM and inspire future innovators*) are indeed broadly aligned with Road-STEAMer's own recommendations. However, despite making welcome steps forward, we argue that adopting a STEAM lens would have made the STEM-ESP more ambitious and future-oriented, and that it therefore makes sense to consider a STEAM driven approach as STEM-ESP is interpreted and implemented.

¹ European Commission. (2025). *A STEM Education Strategic Plan: Skills for competitiveness and innovation*, COM(2025) 89 final. Retrieved from <https://education.ec.europa.eu/document/stem-education-strategic-plan-legal-document>

First, while acknowledging the importance of skills-based learning and problem solving, the STEM-ESP maintains a narrow focus on strictly speaking STEM disciplines (Science, Technology, Engineering and Mathematics), without necessarily challenging the way these disciplines are currently taught. We contrast this with holistic STEAM approaches that intentionally overcome disciplinary boundaries, and incorporate artistic and creative perspectives in a plurality of learning paths, promoting the development of critical thinking skills. Mainstreaming STEAM underpinned by the seven [Road-STEAMer principles](#) of: Disciplinary Inter-relationships; Collaboration; Creativity, Real-world Connections; Inclusion, Personalisation and Empowerment; Thinking-making-doing, and Equity, will certainly require more effort and resources, but it has the potential to truly change education.

Secondly, we find that the equality dimension in the STEM-ESP appears to be mostly reduced to a problem of limited female participation in STEM-related fields that are currently facing talent shortages. As a result, the proposed measures are mainly aimed at attracting a larger number of women and people from “diverse backgrounds” (p.9) towards STEM studies and careers. In Road-STEAMer, we advocate instead for more structural interventions to address various layers of exclusion and discrimination. Grounded on intersectionality, we argue that gender is just one of the dimensions to be considered, alongside neurodivergence, disability, socio-economic background, ethnic origin and associated prejudices.

More broadly, we find that the STEM-ESP is excessively skewed towards the objective of filling gaps in the job market, rather than on serving the self-fulfillment needs of learners, which may or may not overlap with those of industry and business. We maintain that the promotion of scientific and artistic literacy, while carrying significant potential to improve individual career paths, are also beneficial for the learners as human beings, and for society at large, particularly in relation to how communities respond and proactively adapt to global challenges such as the climate emergency.

In this policy brief, we will summarise key insights and findings from the Road-STEAMer project, focussing on the aspects that are currently missing in the STEM-ESP, and which we argue should be integrated into its practical implementation.

EVIDENCE AND ANALYSIS

FROM STEM TO STEAM

The first objection that we raise to the STEM-ESP is that, rather than embracing STEAM, its area of application appears to be mostly confined to the four disciplinary domains that make up STEM: Science, Technology, Engineering and Mathematics. Indeed, the STEM acronym is well established across different educational systems and languages², whereas STEAM is not as clear, especially outside of educational research circles. But this is not simply a mere linguistic observation: within Road-STEAMer, great effort has been put into the development of STEAM criteria to assess educational practices, regardless of the label used. These criteria eventually fed into a broader conceptual framework and classification system for STEAM³, whose foundational concept is *relationality*, i.e. relations between disciplines, among learners, and between learners and the broader context and material world. Rather than focussing on the *what* (the disciplines, as

² In francophone countries, the acronym “STIM” is widely used, whereas German-speaking countries refer to “MINT”, but both have the same etymology and application.

³ Yeomans, L., et al. (2025). Practice or Praxis? A Theoretical Classification System for STEAM Education. *Education Sciences*, 15(2). <https://doi.org/10.3390/educsci15020164>

it happens with STEM), the discriminant is *how* learning activities are conducted. In this sense, we consider STEAM approaches those that display a combination of the following characteristics:

- **Disciplinary inter-relationships:** from fostering connections among disciplines to more transdisciplinary integration of various skill areas and competences;
- **Creativity:** intended both as a descriptor of the activities themselves, and as an outcome of engaging in STEAM practices;
- **Collaboration:** it can be encouraged via specific mechanisms such as game-based learning, as well as modelled by teachers who act as facilitators and cooperate with colleagues and others.
- **Real-world connections:** providing a sense of purpose and efficacy by linking **learning with actual** challenges, promoting problem-solving abilities;
- **Thinking-making-doing:** three interconnected processes that can be nurtured in “thinkering” types of activities, encouraging learners to take an active and critical role;
- **Inclusion, personalisation and empowerment:** promoting learning environments where all can find their paths and valorise their strengths - as opposed to rigid blueprints and “one-size-fits-all” approaches.
- **Equity:** highlighted as an underlying value of STEAM practices⁴.

If these characteristics are present, then the practice can be considered STEAM, even if it is not labelled as such. This overcomes the problem of “STEAM” being a less common term outside of certain (predominantly anglophone) educational research circles.

Characteristics for STEAM activities and projects

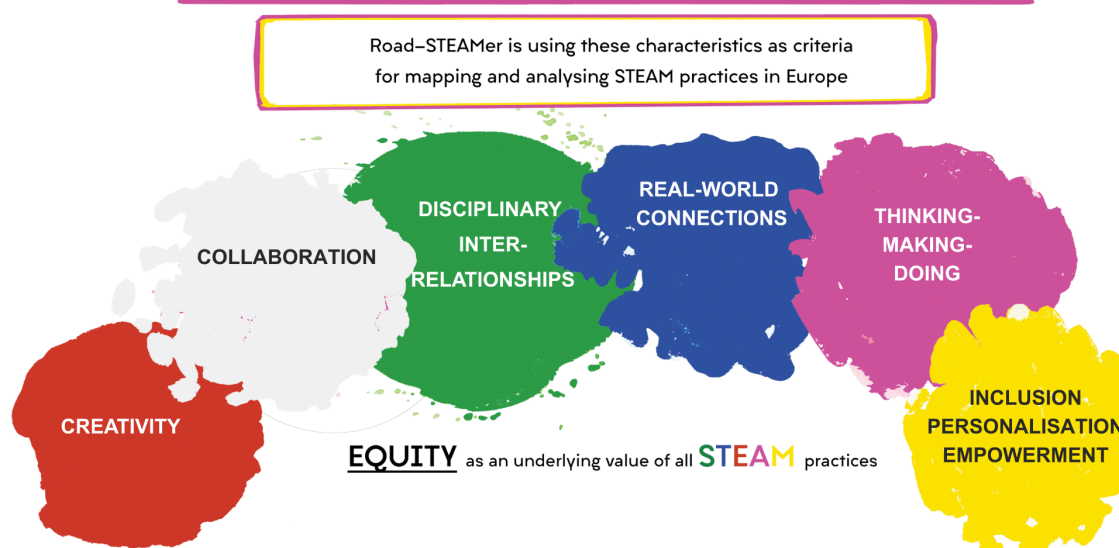


Figure 1: Visualisation of the key characteristics of STEAM practices

⁴ Chappell, K., & Hetherington, L. (2023). *Road-STEAMer Research Framework (criteria)* (Deliverable 4.1). Road-STEAMer Project. https://www.road-steamer.eu/wp-content/uploads/2024/01/D4.1_Research-Framework.pdf;

Yeomans, L. et al. (2023). *Road-STEAMer Conceptual Framework* (Deliverable 2.2). Road-STEAMer Project. <https://www.road-steamer.eu/wp-content/uploads/2024/02/RoadSTEAMer-D2.2-Concpetual-Framework.pdf>;

Chappell, K., Hetherington, L., Juillard, S., Aguirre, C., & Duca, E. (2025). A framework for effective STEAM education: Pedagogy for responding to wicked problems. *International Journal of Educational Research Open*, 9, 100474. <https://doi.org/10.1016/j.ijedro.2025.100474>

The deliberate integration of scientific and artistic literacy is not just as a different way of teaching (learning inputs), but —more importantly— promotes different forms of knowledge production and making sense of the world (learning outputs). In this sense, STEAM approaches have the potential to support learners in acquiring the skills they will need to flourish as human beings and as professionals/workers in a rapidly changing world, something that would help achieve the goals of the STEM-ESP, and contribute to societal responses to global challenges.⁵

By explicitly adopting such a broader, process-based concept of STEAM, the STEM-ESP could stand out as a decidedly more innovative transdisciplinary framework, paving the way for educational reform across the continent. This is a call to effectively include broader STEAM skills informed by relationality, especially in the competence framework and taxonomy of skills to be completed in 2026. Additionally, it would be crucial to ensure that the mandate of the proposed STEM foundries explicitly encourages the adoption of STEAM practices. Openly embracing creativity would also be in line with the path indicated by OECD with the inclusion of creative thinking in the most recent PISA assessments⁶.

INCLUSIVITY BEYOND GENDER EQUALITY

As mentioned above, *Equity* is an underlying value that informs Road-STEAMer's framework for STEAM education, and *Inclusion, personalisation and empowerment* is one of its key characteristics. This is informed by an earlier literature review on the Socio-Economic Context and Relevant Needs, which highlighted how gender is only one element in a broader framework of exclusion. Socio-economic background, which is closely correlated with other drivers of exclusion such as ethnicity, family structures, and language spoken at home, is of particular relevance here. Not only a lower socio-economic status is often a predictor of poorer educational outcomes, but higher-income status has been shown to compensate for other negative predictors, like gender and ethnicity.⁷

All this considered, the focus on “advancing women in STEM” in the STEM-ESP appears important but narrow, precisely as it misses out on broader considerations grounded on intersectionality. Female underrepresentation is only one element of a more complex puzzle, albeit one that is more visible and more easily measurable than others. But often, it is people who find themselves at the intersection of multiple drivers of inequality that face the most obstacles in their studies and career prospects. Hence, identifying successful best practices for girls and women is commendable, but it should be coupled with a similar effort in identifying, and promoting, practices that help against other causes of marginalisation and difficulties, aiming to lift all barriers, not just some.

Furthermore, we argue that the “headcount” framing of many initiatives —such as “increasing the number of graduates”, “addressing employers' needs”, “attracting more women” (or people from currently underrepresented backgrounds, for that matter)— is too focused on the short term. While we certainly appreciate the time constraints of European policy initiatives, we maintain that these measures should be accompanied by bolder systemic changes to reform education and address root causes of exclusion and discrimination affecting not just biological women, but people expressing a variety of genders, (dis)ability statuses, ethnic and socio-economic backgrounds, as well as the root causes of current misalignment with societal and learners' needs.

⁵ Unterfrauner, E., et al. (2024). STEAM Education: The Claim for Socially Innovative Practices. *Creativity and Educational Innovation Review*, (8), 71–98. <https://doi.org/10.7203/CREATIVITY.8.29743>

⁶ OECD. (2024). *New PISA results on creative thinking: Can students think outside the box?* (PISA in Focus, No. 125). OECD Publishing. <https://doi.org/10.1787/b3a46696-en>

⁷ Unterfrauner, E. et al. (2023). *Socio-economic context and relevant needs* (Deliverable 2.1). Road-STEAMer Project. <https://doi.org/10.5281/zenodo.14000682>

More broadly, it would be important to view education not merely as ancillary to industry and business (preparing the workforce of the future), but central in its own right. In a world that is increasingly digital and technological, but also rapidly changing, everyone can benefit from gaining better STEAM-related competencies, even if not immediately linked to occupational advantages.

ALIGNMENT OF THE STEM-ESP WITH ROAD-STEAMER PRIORITY AREAS

The Road-STEAMer roadmap proposes a range of research actions that the EU should fund over the next decade to promote STEAM education. The Roadmap has been developed as an interactive matrix, where recommended actions are displayed across four main thematic areas:

1. Strengthening the STEAM Curriculum at National and EU level,
2. Enhancing Teacher Training and the Learning Environment,
3. Aligning STEAM education and career design with societal and industrial needs - STEAM, literate citizens
4. Promoting equity with transdisciplinary, effective & inclusive STEAM education paradigms.

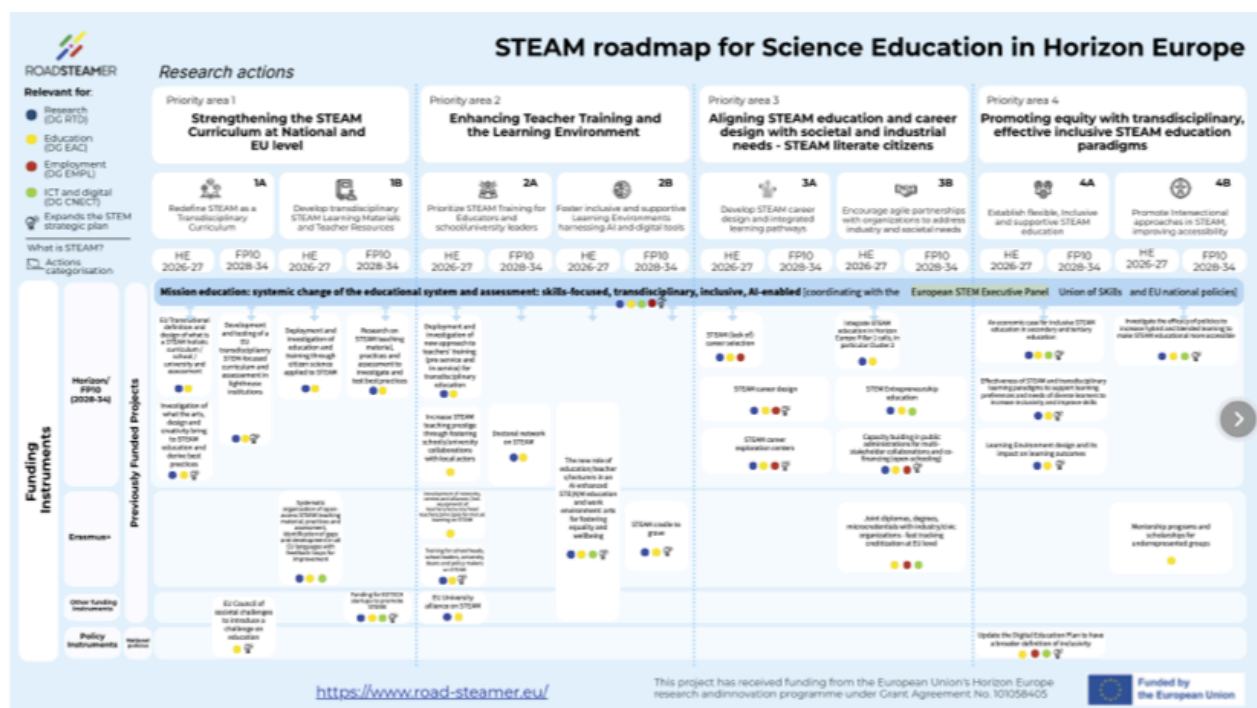


Figure 2: "Matrix" visualisation of the Roadmap.

The interactive version is accessible on <https://www.road-steamer.eu/steam-edu-roadmap/>

In the interactive visual version of the roadmap, actions that expand the scope of the STEM-ESP are clearly marked with a lightbulb symbol. While half of the thirty recommended actions are broadly aligned and compatible with the STEM-ESP, the remaining half go beyond its scope. This is particularly true of priority area 4 (*Promoting equity [...] paradigms*) which explicitly looks at supporting diverse learning needs to be more inclusive towards underrepresented groups, including all gender identities, people with disabilities, autism, ADHD, sensory processing sensitivity, low socio-economic status, and migration background.

POLICY IMPLICATIONS AND RECOMMENDATIONS

Taking into account the results of the Road-STEAMer project summarised in the previous pages, the main recommendations aimed, on the one hand, at broadening the scope and potential impact of the STEM-ESP by actively encouraging inter- and transdisciplinary practices that go beyond a narrowly defined STEM field, and, on the other hand, at promoting truly inclusive education that puts the diverse needs and aspirations of learners at the center, and adapts to them.

As a first step, we propose the following adaptations:

- **Under “LEAD”, include indicators of diversity that go beyond biological sex**, including at the very minimum disability and socio-economic status;
- **Under “LEAD”, include an additional target related to the uptake of innovative pedagogical practices** linked to STEAM approaches such as transdisciplinary activities, project-based learning, “thinkering” types of activities.
- **Under “Level UP”, expand the scope of the competence framework and taxonomy of skills** to be developed by 2026, including not just skills pertaining to strictly defined STEM disciplines, but a broader range of STEAM competences such as creative and critical thinking.
- **Under “Level UP”, ensure that the mandate of the STEM education centers encourages STEAM approaches.** This would allow learners to find multiple paths and career options, including –but not limited to– sectors facing talent gaps, as well as areas that are strategic for the future of Europe (and beyond) such as the green transition, with a strong focus on equity and inclusion.
- **Expand the scope of “LIFT barriers” from their original focus on gender underrepresentation to include actions aimed at lifting all barriers** faced by different groups of people, based on existing best practices and/or to be explored with dedicated research funding.

Furthermore, and going beyond the scope of the STEM-ESP, Road-STEAMer recommends that the European Commission institutes **an EU Mission on Education** alongside the existing EU Missions, with the aim to coordinate efforts and promote evidence-based educational reforms, with specific attention to inclusiveness and accessibility. Establishing an EU Mission would guarantee the mobilisation of long-term research funding at the required scale to achieve significant systemic innovation in educational systems across Europe. Furthermore, creating a dedicated EU Mission would also put education on center stage, recognising that providing high-quality, innovative education at scale across Europe is one of the greatest challenges of our times.

SUSTAINABILITY AND LEGACY

All key Road-STEAMer outputs, including scientific publications, selected project deliverables, and other resources developed as part of the project, are available on the [Road-STEAMer community page on the open access repository Zenodo](#), to ensure that they remain openly accessible for the foreseeable future.

KEY INPUTS FOR EDUCATORS, SCHOOL LEADERS, POLICYMAKERS

All public and private initiatives working on STEAM education – or willing to promote a shift from STEM to STEAM – are encouraged to explore Road-STEAMer’s conceptual framework as a starting point for further elaboration and tailoring to the specific context(s). The academic article [“A framework for effective STEAM education”](#) presents the research framework outlined in [deliverable D4.1](#) and applies it to a case study, whereas [Practice or Praxis? A Theoretical Classification System for STEAM Education](#) elaborates on the project’s conceptual framework ([deliverable D2.2](#)).

The [interactive map of STEAM practices](#) can also serve as an additional source of inspiration, providing a series of real-life examples of STEAM education.

KEY INPUTS FOR POLICYMAKING

The [Road-STEAMer Roadmap](#) presents a series of funding recommendations aimed at the European Commission, especially REA under DG RTD, DG EAC, DG CNECT (each indicated by a differently coloured dot in the interactive version). Despite being explicitly addressed to the European Commission, it can be used as a source of inspiration by other funding actors at regional or national levels, who could start funding some of the recommended actions.

Furthermore, policymakers at European, National and local level, as well as leaders of educational institutions, can also take inspiration from Road-STEAMer’s own [policy recommendations](#) (excerpt from deliverable D3.3) as well as from the [STE\(A\)M Atlas recommendations](#) jointly developed with projects The SEER and Sense.

A TOOLBOX FOR STEAM

Additionally, the Road-STEAMer website includes an [interactive version of the Toolbox](#) developed in deliverable 6.4. This modular set of materials offers a rich collection of content, inspirational best practices, and success stories, catering to diverse members of the stakeholder community.

RESEARCH PARAMETERS

The overall aim of the Road-STEAMer project was to develop a roadmap for STEAM education in Horizon Europe and, more broadly, in educational policy across the continent. Road-STEAMer has focused on incorporating creative thinking and applied arts, enabling integrated science learning approaches and stronger connections among different educational levels, including higher education, informal, and non-formal science education, as well as the world of industry and business. The core approaches adopted by the project consortium emphasise:

- collaboration and co-creation with the stakeholder communities, science and arts education, research, innovation and creativity;
- a bottom-up approach emphasising educational practice and practitioners’ agency;
- a specific focus on ways to leverage the power of STEAM approaches, as manifested through [exemplary cases and best practices](#).

Road-STEAMer triangulates findings and needs emerging from stakeholder engagement and the analysis of the STEAM practices with the knowledge produced from the analysis of scientific literature, policy strategic documents, current educational policies, contexts and frameworks.

PROJECT IDENTITY

PROJECT NAME	Developing a STEAM Roadmap for Science Education in Horizon Europe (Road-STEAMer)
COORDINATOR	The Lisbon Council for Economic Competitiveness asbl, Brussels, Belgium, info@lisboncouncil.net
CONSORTIUM	<ul style="list-style-type: none">• Association Européenne des Expositions Scientifiques, Techniques et Industrielles (ECSITE), Brussels, Belgium• Centrum Nauki Kopernik, Warsaw, Poland• National Center Junior Academy of Sciences of Ukraine, NC JASU, Kiev, Ukraine• Association TRACES Théories et Réflexions sur l'Apprendre, la Communication et l'Éducation Scientifiques, Paris, France• Ellinikh Enosh Dhmosiografon Episthmhs, Syggrafeon Episthmhs Kai Eikoinoniologon Episthmhs Astiki Etaireia (Science View), Nea Ionia, Greece• Ellinogermaniki Agogi Scholi Panagea Savva AE, Pallini, Greece• Engineering - Ingegneria Informatica S.P.A., Rome, Italy• European School Heads Association (ESHA), Utrecht, Netherlands• Panteio Panepistimio Koinonikon Kaipolitikon Epistimon, Kallithea, Greece• Politecnico di Milano, Milan, Italy• Università ta' Malta, Msida, Malta• Zentrum für Soziale Innovation (ZSI), Vienna, Austria• University of Exeter, Exeter, UK
FUNDING SCHEME	HORIZON.4.2 – Reforming and enhancing the European R&I System (main) and HORIZON.4.2.4 – Open science; call HORIZON-WIDERA-2021-ERA-01, Topic 70 Developing a STE(A)M roadmap for Science Education in Horizon Europe.
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BUDGET	EU contribution: 1 660 625 €.
WEBSITE	www.road-steamer.eu
FOR MORE INFORMATION	Contact: Francesco Mureddu, francesco.mureddu@lisboncouncil.net ; Annalisa Addis, annalisa.addis@lisboncouncil.net
FURTHER READING	Roadmap: interactive PDF Policy recommendations STE(A)M Atlas joint recommendations



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