MEMORANDUM

EU STEM COALITION
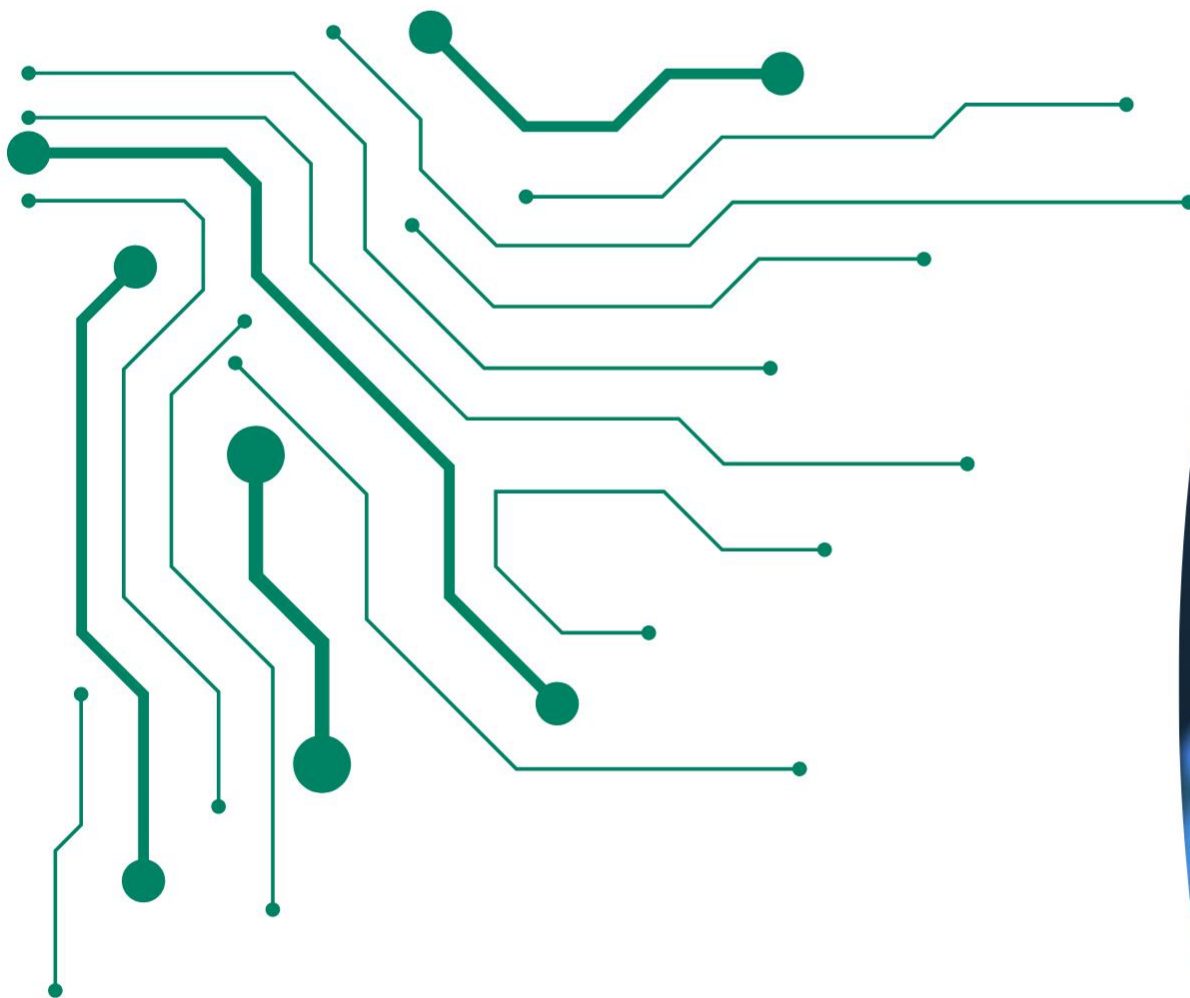
Science Technology
Engineering Mathematics

TOWARDS BETTER STEM POLICIES AND IMPLEMENTATION

RECOMMENDATIONS FOR THE NEXT STEPS

Towards better STEM policies and implementation: recommendations for the next steps

EU STEM COALITION
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Technology is increasingly becoming an integral part of our society. Technological developments are indispensable for realizing the transitions that will sustainably protect our prosperity and well-being and strengthen our competitiveness. From healthcare to hospitality, industry and agriculture, technology is ubiquitous in various professions. STEM skills are crucial for everyone to increase their opportunities in both society and the labor market. That is why it is important that everyone has the opportunity to acquire and to further develop these skills. Building on existing infrastructure, more bottom-up approaches, and a focus on inclusion will be essential to achieving such ends. Through these means, we can ensure sufficient technical and digital talent, as well as realize a more democratic, safer, and sustainable future for Europe.

Key messages

1) **Increase reach and impact by building on existing, large scale national and regional programme infrastructure and networks, with a focus on implementation and up scaling.**
   - *Recommendation to EU institutions*
     - So as to implement programmes and facilitate best practice sharing on the EU level, we recommend EU institutions to take advantage of existing and active networks (such as the EU STEM Coalition) for the implementation of current and future policies;
     - We recommend that the European Commission considers the importance of STEM in its upcoming Action Plan against Skills Shortages as well as in the next work programme. This could be done by again introducing a European target for STEM graduates;
     - Include a STEM dimension in *call texts* as well as any EU programmes where it could be relevant.
   - *Recommendation to EU STEM Coalition members*
     - The EU STEM Coalition plays an important role in collecting data on STEM education, reach and equity. It is therefore necessary that we continue to increase our efforts to support EU and EU Member States' policy interventions;
     - The EU STEM Coalition has been playing an active role in facilitating the sharing of best practices on the European level. This has proven to be a valuable contribution to STEM development, and it is therefore important that the Coalition continue to play such a role.
   - *Recommendation to Member States*
     - We recommend that member states set up a national STEM strategy. This can be done based on best practices from other countries, then adapted to the national as well as regional ecosystems.
2) **Strive for flexibility and move towards facilitatory, bottom-up approaches to increase impact and adapt to the varying local, regional and national needs in the member states.**
   - *Recommendation to EU institutions*
     - The Erasmus+ programme would benefit from prioritizing fewer highly funded Erasmus+ projects with high impact over numerous small and dispersed projects;
     - Stimulate EU initiatives which take into account regional dimensions and ensure future cohesion policy planning has a more targeted approach to STEM skills shortages.
   - *Recommendation to EU STEM Coalition members*
     - We recommend our members to play a facilitatory and connecting role on the local, regional, national, and European level;
     - Our members can support the adaptation of EU initiatives to meet the needs of regional ecosystems.
   - *Recommendation to Member States*
     - Include attention to STEM skills in future cohesion policy programmeming in specific regions.

3) **A greater degree of focus on inclusion in STEM programmes and policies**
   - *Recommendation to EU institutions*
     - Continue to play an active role in increasing the EU's ambitions for including women in STEM;
     - Take a broader approach to inclusion in STEM by extending the focus to under-represented groups as well as including geographic diversity in consideration to inclusion. This could be implemented in vocational education & training as well as early childhood education.
   - *Recommendation to EU STEM Coalition members*
     - Actively take part in programmes focused on inclusion at the regional, national and EU level;
     - STEM platforms should support candidate member states with setting up STEM strategies.
   - *Recommendation to Member States*
     - We recommend you broaden your approaches to inclusion in national STEM strategies, so as to ensure no one is left behind.

Overview and motivation

Europe is facing a wide span of challenges that affect all member states. These challenges range from the need to strengthen strategic industrial sectors, the ramifications of rapid digitalization, the fight on climate change, to promoting open, inclusive and sustainable societies. What all of these diverse challenges have in common is that they will require innovative, STEM[1]-driven solutions.

The EU STEM Coalition is a network of national and regional organisations that works to strengthen and diversify STEM education in Europe. The 46 STEM platforms from 21 countries our network[2] represents are tasked with the coordination and implementation of national / regional (STEM) skills strategies. Through their large-scale programme infrastructure they reach the majority of students, teachers and institutions in their specific contexts.

- Through its Jet-Net & Tech-Net programmes the Dutch Platform Talent for Technology reached 54% of the primary schools and 74% of the secondary schools in the Netherlands;
- In the Basque Region Innobasque reached 400 primary and secondary schools in 2021-2023, covering 58% of the region's schools;
- Denmark's national STEM platform Astra reaches over 1.000 teachers a year through its Big Bang science teacher conference and 150.000 pupils in the National Science Week with 150.000 pupils;
- In 2022, 221 Flemish municipalities had a STEM academy that organized at least one series of STEM activities;

Building on this knowledge, reach and expertise, the EU STEM Coalition has supported the development of new national and regional STEM strategies, implementation programmes and organisations, with concrete results[3].

The EU STEM Coalition website is a repository of Europe wide STEM data, best practice programmes in STEM, articles on STEM education and much more. The network has also contributed to the visibility of the individual members (platforms) and programmes. This has sparked EU-level responses. An example of this can be seen in the European Commission's 'Centres for Vocational Excellence' (CoVE) pilot-initiative, which, with the help of the EU STEM Coalition, was modelled after the Dutch Centres for Vocational Innovation, of the Dutch national STEM platform.

The efforts of our network have been recognized on the EU-level, and the EU STEM Coalition has been included in several EU-objectives, including the *Communication on a Renewed EU Agenda for Higher Education* (2017), the *Digital Education Action Plan 2021 - 2027* (2020), the *Communication on Achieving the European Education Area by 2025* (2020) and the *European Chips Act* (2022). The EU has also continued to recognize the importance of STEM in general, as a driver of economic competitiveness, the energy transition as well as a requirement for active citizenship[4]. By doing so, the EU has been invaluable in setting the political agenda and boosting the momentum of the STEM topic. The EU STEM Coalition lends to this strategic priority.

In support of these ambitious objectives, the EU has also invested heavily in increasing STEM uptake through its various funding programmes (Erasmus+, Horizon Europe, etc.) as well as through implementing its own initiatives.[5] Despite the laudable efforts of such EU funded programmes, a clear disconnect persists between EU-level actions focused on STEM and analogous efforts on the national and regional levels. As a result, the reach, uptake and impact of EU initiatives in STEM are hindered from achieving their full potential.

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[1] STEM, abbreviation of Science, Technology, Engineering and Mathematics. Whenever STEM is used in this paper, we mean integrated STEM, with which STEM education is complementary to any other type of education and vice versa.

[2] Including non-EU member states like Norway, Switzerland, United Kingdom, Albania, Ukraine, etc. For a full overview, see: www.stemcoalition.eu/members

[3] Including the Danish Technology Pact (national STEM strategy), STEAMsare (programme for school-company partnerships in secondary education) and the Hungarian STEM platform (organisation) based on existing models. For a full overview of ongoing support actions, see: www.stemcoalition.eu/taskforces

[4] See for example: European Commission (2015), *Science Education for Responsible Citizenship,* (https://op.europa.eu/en/publication-detail/-/publication/a1d14fa0-8dbe-11e5-b8b7-01aa75ed71a1)

[5] For example: the Girls go Circular-initiative of EIT implements the objective to increase women's participation in STEM, (https://eit-girlsgocircular.eu/)

What is needed

Such issues would be well addressed by a more flexible, bottom-up implementation of EU initiatives in the field of STEM promotion. This approach should first and foremost build on the reach and expertise of the existing national and regional large-scale programmes and networks that are already in place. Building on pre-existing initiatives will lead to a substantially higher degree of impact relative to the resources invested. Furthermore, embedding EU-funded initiatives into the existing programmes and networks will help reduce the fragmentation of initiatives.

The European Commission has the opportunity to act as a catalyst for the development and upscaling of new, innovative, and effective approaches for providing more context to STEM, increasing uptake and diversity, and strengthening Europe's capacity to tackle a range of issues that affect all Member States. The aforementioned issues have become even more pressing following the new challenges that all Member States are facing, such as the rapid energy transition, shortages of STEM-skilled people, and increasing skills gaps caused by crises, such as the Covid-19 pandemic.

The members of the EU STEM Coalition are eager to help. As central players in their countries and regions, they can act as expert partners in transmitting as well as adapting the Commission's initiatives to meet local needs. Furthermore, they can support rapidly upscaling initiatives via existing networks and programmes.

Recommendations – extended version

The members of the EU STEM Coalition recommend EU institutions, STEM platforms, industry and Member States to:

1) **Increase reach and impact by building on existing, large scale national and regional programme infrastructure and networks with a focus on implementation and up scaling.**

Why? National and regional programme infrastructure and networks have the potential to dramatically increase uptake and reach of existing and future EU-initiatives in STEM. This can be done by leveraging the existing trust, data, and expertise within such networks to facilitate rapid upscaling. The Commission and its Member States would be well advised to utilize active networks with a proven track record, as well as known stakeholders in the field, to implement STEM development programmes. This will result in increased impact of the programmes, as well as their degree of sustainability.

How?

- We recommend that the European Commission includes a prominent place for STEM in the upcoming Action Plan against Labour and Skills Shortages, seeing as many shortages are most urgent in STEM-related sectors. This could be initiated by tabling a proposal for a Council Recommendation on STEM education in Europe, which includes:
  - A new target to remedy the gender imbalance among STEM graduates, while securing a significant overall increase in total number of STEM graduates, in light of the twin transitions. The EU had such a target from 2000-2010 in its Lisbon Agenda which proved effective in increasing the number of STEM graduates. This was unfortunately discontinued after reaching the target;
  - A recommendation to Member States to set up or update national STEM strategies, as currently less than half of the Member States have a STEM strategy in place;
  - Set up and finance an EU STEM Platform, to encourage and support collaboration and best practice sharing between STEM platforms, academia, industry representatives and policy makers. National and regional EU STEM Coalition members are ready to take an active role in this platform;
  - We encourage Member States to collect data on STEM, with the support of national and regional STEM platforms.
  - The foundation of an Expert Group on STEM education, to investigate effective STEM education interventions in Europe
  - To encourage Member States to duly support STEM-related initiatives in EU's Employment Guidelines as part of the European Semester;
- To mainstream STEM across the programmes and policies of different DGs in the Commission, we recommend including a STEM dimension or alignment with national STEM strategies in all policies and calls, where relevant.
- The current Commission put focus on tabling an ambitious agenda for digital, green and industrial transition. We recommend the next Commission shifts its focus to support Member States with

implementation of these ambitious policies by closely aligning EU funding with the national and regional strategies which are in place.

- The Erasmus+ programme could benefit from a Policy Support Facility, similarly to the Horizon Europe Policy Support Facility, to support (new and candidate) member states with introducing reforms in their education systems. For example, in the field of STEM;

2) **Strive for flexibility and move towards facilitatory, bottom-up approaches to increase impact and adapt to the varying local, regional, and national needs in the Member States.**

Why? There is a need to increase the flexibility of EU initiatives in pre-tertiary, vocational, and tertiary STEM education to better respond to the local, regional and national needs in the Member States. For initiatives implemented by the EU itself, this means that a shift towards more decentralized implementation models is required. This could take the form of adaptation and integration of existing national or regional initiatives. Promoting STEM differs per context, and one size fits all-models do not work in differing contexts.

How?

- For EU-funded initiatives, more emphasis should be placed on integrating projects within the national and regional context. To this end, systematic alignment with national and regional STEM strategies should be taken into account in the evaluation of project proposals.

- The Erasmus+ programme would benefit from prioritising fewer highly funded Erasmus+ projects capable of innovative and groundbreaking approaches over numerous small and dispersed initiatives, as advocated for by one of our members, CESAER[6];

- The Erasmus+ Centres of Vocational Excellence are an excellent example of highly funded and more decentralized implementation models in the EU's directly managed programmes. This due to their taking into account the diversity of local needs whilst stimulating international cooperation and exchange of good practices;

- We recommend giving priority to supporting STEM-related initiatives at the local and regional level and take the measures needed to ensure that future cohesion policy planning has a more targeted approach to shortages of STEM skills. This could greatly contribute to the goals of the EU's Harnessing Talent in Europe's Regions Initiative;

3) **A greater degree of focus on inclusion in STEM programmes and policies**

Why? Inequality in STEM education in Europe manifests itself in a variety of ways. This can be seen in that in the EU women make up only a third of STEM graduates[7] and 19% of ICT specialists. Similarly, several studies[8] found that students with a migration background are less likely to enroll in STEM-related studies after secondary education, and perform worse in these programmes than native students. Furthermore, statistics show labour market tensions prevail in both vocational and academic occupations in STEM fields. However, in recent decades, fewer graduates have been choosing a vocational pathway, due to a combination of factors, such as the subject's perception in society. As many STEM occupations are vocational, addressing this problem will have a catalyzing effect on the number of STEM graduates. Lastly, inequality also manifest itself geographically, as (citizens of) applicant and recent member states have fewer opportunities to join STEM projects, studies, and jobs.

How?

- We find that initiatives such as GirlsInStem and the STEAM manifest are excellent examples of effective actions to address the gender disbalance in STEM. We believe the EU should further increase efforts which facilitate the participation of girls and women in STEM fields, via regional and national STEM platforms. We commend the European Parliament on its call to support the EU STEM Coalition to develop (higher) education curricula which attract women to engineering and ICT and emphasizes the role it can play in

[6] CESAER - Position on Erasmus
[7] EIT RawMaterials: Pioneering STEM Initiative Achieves 100% Surge in Young Women's Participation.
[8] Maastricht University - Comparing success of female students to their male counterparts in the STEM fields: an empirical analysis from enrollment until graduation using longitudinal register data

promoting STEM in all sectors of education.

- The EU STEM Coalition is ready to support the Commission by contributing to programmes which orchestrate the collection of comparable international data. Such data would help track the progress of women and students from different socioeconomic backgrounds or racial and ethnic origins in STEM fields and enable targeted EU or Member States policy interventions to address inequalities.

- Labor market tensions prevail in both vocational and academic occupations in STEM fields.[9] To make the twin transitions in Europe successful, it will be important to increase attention on vocational education & training (VET) as well as increase its attractiveness. This could be done by expanding the budget of the Centres of Vocational Excellence and setting up other measures and initiatives to increase attractiveness of VET. It is also essential to see VET institutions as equal partners and important players in educational ecosystems. To this end, we recommend to better integrate VET in calls of other STEM-related programmes such as Digital Europe, Horizon Europe and the EIT.

- Increasing focus on including EU candidate states in Erasmus+ projects and funding opportunities concerning STEM. There are great gains to be achieved in Western Balkan countries as well as Ukraine and Moldova. Considering that these countries are EU applicant states, it is all the more necessary to include them in European projects and support their STEM development. It has been the experience of the EU STEM coalition that the aforementioned candidate states are ready and eager to pursue the development of their nation's STEM education, in cooperation with the rest of Europe. Furthermore, it has been made clear to the EU STEM Coalition, through its Balkan and Ukrainian member organizations, that better access to teacher exchange opportunities would be of great value to STEM development in these countries. This would be due to the cultural shifts which exchange opportunities would induce in teachers, thereby improving the quality of STEM education.

- EU's Neighbourhood Development and International Cooperation Instrument, in connection to Erasmus+, could be better utilised to promote STEM in third countries via the capacity building projects and exchanges. This in turn will contribute to increasing the EU's Talent Pool

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[9] Cedefop (2023): Skills in transition: the way to 2035 (europa.eu)