STEM STRATEGY

2021-26 Action Plan

In 2018, the European Commission published a report from the Expert Group on Science Education (OECD PISA Results in Focus Report 2018). This report declares, that inquiry-based and accessible science education has to be a key component of people's learning Continuum. Efforts need to be made to improve the quality of teaching. In this sense, collaboration among educators, enterprises and civil societies is necessary and vital.

Our project addresses the need to develop and take on new approaches to teaching and learning science, technology, engineering and mathematics (STEM); and to use new technologies to support and facilitate this.

This Action Plan identifies priorities arising from the State of the Art Report (SoAR), which was developed as one of the main outputs of the project. The SoAR draws conclusions from the survey completed by 198 STEM teachers across Europe, who provided information about the status of their current teaching methods, challenges as well as existing professional development opportunities for STEM educators at the national level.

Based on the findings of this report, it is very clear, that a lot of work needs to be done on the training of teachers regarding student engagement and motivation, which was the most significant challenge participants identified. Therefore, student engagement and motivation is the major key driver of this Action Plan and the other 4 key drivers were identified based on the responses for the teaching methodologies and professional development opportunities sections of the survey, namely: Better teaching methods, Teacher Training, Education technology and STEM Careers Advice. A focus on these key drivers with the collaboration of education influencers and policy makers will allow us to work towards our outcomes and achieve real improvements.

To stay updated on the progress and impact of our project, and to access project outputs such as e-modules and lesson plans for STEM teachers, please visit
www.improving-stem-education.eu

Co-funded by the Erasmus+ Programme of the European Union

IMPROVING STEM EDUCATION ACROSS EUROPEAN SCHOOLS

2020-1-UK01-KA201-078810

ABOUT US

The consortium comprises of six project partners from the United Kingdom, Turkey, Italy, Romania, Belgium and Greece, involving a secondary school, a university college, a private vocational school & research centre, 2 NGOs and an SME. The diverse background and expertise of the partners add a great value to the project.

OUR GOAL

To provide STEM teachers and educators with the resources and methodologies they need to teach more effectively and to make STEM subjects more interesting in the eyes of their students. The consortium will play an essential role, working in partnership with the broader STEM sector, to support and advocate for action on STEM education.

2021 ACTION PLAN – KEY DRIVERS

TEACHER TRAINING

It has been demonstrated that professional development opportunities vary according to the cultural and institutional context in the 6 European partner countries. Only 13% of the 198 respondents stated that participating in CPD (professional development) activities on a yearly bases is compulsory. However, 51% of the respondents stated that they would like to participate in various professional development activities.

BETTER TEACHING METHODS

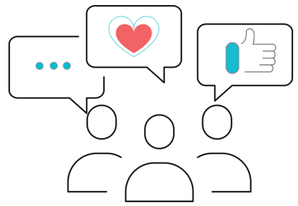
The majority of the teachers from the partner countries stated that they use ‘Traditional Direct Instructions’ for 25% and 50% of the class. Although direct instruction is an accepted form of teaching, however, if it is carried out with no other variation within the lesson on a long-term basis, this can lead to students losing interest and becoming disenfranchised from the learning process. The following teaching methods, Teaching with experiments, Flipped Classroom and Inquiry based learning, are used mainly for 25% of the class, which depending on the length of the class, is an average of 12 minutes. To get the best results from these methodologies, it is recommended to employ them for more than 25% of the class and have a consistent approach when using them as a learning tool.

STUDENT ENGAGEMENT AND MOTIVATION

Based on the findings of the SoAR, student engagement and motivation was the biggest challenge respondents faced, especially during the COVID-19 pandemic. Hence, this area is the main key driver.

Research shows that student engagement constitutes a crucial precondition for optimal and deep-level learning and provides better long-term vocational opportunities. Additionally, student engagement is associated with students’ motivation to learn.

In conclusion of the SoAR, the following associated key drivers were identified: Teacher Training, Better Teaching Methods, Educational Technology and STEM Careers.



STEM CAREERS

75% of the respondents stated that they do not teach careers lessons, where they inform students about STEM careers, help them with CV writing and mock interviews. Additionally, only 13% of the respondents stated that they or their schools have links with the industry, providing an opportunity for students to gain insight to the wide range of STEM careers, teaching/demonstrating items that cannot be accessed at school, providing problem solving challenges and industry based learning.

EDUCATIONAL TECHNOLOGY

Educational technology was one of the main areas respondents (57% of respondents) would like to get training on, including robotics and coding.

Robots and/or boards (e.g. aurdino, micro:bit) were the least used methods of learning resources with 113 of the teachers spending 0% of the lessons with this resource. The most popular methods of learning have shown to be Audio and Video and Web/Computer based simulation with an average of 40% of the teachers spending 25% of the lesson using these resources.

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RECOMMENDATIONS FOR GOVERNMENTS

TEACHER TRAINING & BETTER TEACHING METHODOLOGIES

Continuing Professional Development (CPD)

COVID-19 has placed significant stress on the education system and on our young people. Technology has played a key role ensuring that our students can continue with their learning. However, the ease of access to teaching and related resources in STEM continues to be important, so teachers can provide a high-quality learning experience for young people.

It is clear from the results of the SoAR, that teachers in most of the partner countries would benefit greatly from teacher training workshops on the appropriate use of teaching methodologies and strategies within the classroom. It should be noted that these innovative strategies need to be planned out and need to be appropriately used or their effectiveness will be diminished. There needs to be a culture of innovation within the schools, in order for teachers to adopt these innovative technologies such as game based learning and the use of robotics and other similar types of innovative technologies

As part of our project, the consortium will develop a number of STEM lesson plans and e-modules for primary and secondary school teachers in order to:

- support their professional learning,
- be able to raise their own confidence and expertise in STEM, so they can deliver engaging and motivating STEM lessons
- provide them with high-quality, curriculum linked, ready-to-use lesson plans.

Create a Systemic and Transformative Change

In order to create a meaningful and lasting change in regards to STEM teacher CPD, it is fundamental to provide mandatory professional learning accounting to a minimum of 5 days per academic year on top of the existing requirements, including curriculum linked high quality professional learning, digital skills, computer science, programming and robotics, and STEM subject specific professional learning.

STEM CAREERS

Implement an effective STEM careers guidance programme

Implement STEM careers advice lessons into the curriculum from as early as 7 years of age. As a valid and reliable STEM careers advice is crucial to make young people aware of the wide range of up-to-date careers available to them. This can influence their interest in STEM subjects during primary and post primary school. Additionally, this can further influence their decisions when they choose their GCSE or A level subjects (UK) or when they choose the type of post primary school or vocational school (European countries).

Encourage schools, STEM Ambassadors and STEM teachers to develop links with local STEM businesses, so that industry visits can be arranged allowing students to visit the facilities and learn more about particular STEM jobs. Guest speakers can also be invited to school to provide first hand information about STEM jobs.

Promote the opportunities and benefits of STEM learning

Implement Young STEM Professionals programmes and competitions with fun STEM activities to inspire young people.

Implement STEM Awards to further inspire young people and for educational organisations to develop effective STEM strategies and implement their action plans. This will also support STEM gender imbalance strategies. Such awards should be available across all levels of education from early childhood to higher education.

Provide STEM funding opportunities for qualifying organisations to be able to implement STEM projects and cross-disciplinary lessons to inspire young people, to build confidence, skills and knowledge in STEM subjects.

EDUCATIONAL TECHNOLOGY

Educational technology plays a vital role in STEM education as the effective use of digital learning tools in a classroom can increase student engagement, help teachers improve their lesson plans, and facilitate personalised learning. It also helps students build essential 21st-century skills.

Technology is an indispensable component of a STEM activity. The use of technology encourages students to become innovative and to develop creative - and critical thinking skills while they work on their projects.

To prepare young people for the rapidly changing requirements by the modern STEM industry, we must design learning environments that provide all students with unique and engaging opportunities to master STEM skills using the technologies STEM professionals use. However, powerful learning experiences also require effective teachers who are trained on the appropriate use of tools and teaching methodologies and possess up-to-date knowledge and skills regarding industry required programming languages and tools.

Implement Future of STEM Education Excellence Awards so that schools can be recognised as models of STEM education.

Provide funding opportunities for qualifying organisations to develop powerful digital tools including STEM simulations, dynamic representations of STEM systems and digital assessments. This will enable schools to implement new, research based approaches, to leverage technology in order to improve STEM education.

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RECOMMENDATIONS FOR GOVERNMENTS

TEACHER TRAINING & BETTER TEACHING METHODOLOGIES

Create a Systemic and Transformative Change

Offer additional training opportunities and resources for STEM Ambassadors, who can act as mentors for their colleagues and support their professional growth within their local area.

Such training opportunities will raise STEM Ambassadors and teachers' confidence and expertise in STEM. Therefore building the capacity of the education and training system to deliver excellent STEM teaching so that young people are inspired to become scientists of the future.

The STEM teacher CPD should include:

- Inquiry based/problem based teaching methodology
- Foundations of computer science and robotics and how these practices can be applied across all STEM subjects.
- Digital skills including online lesson delivery, e-assessment, engaging students during online lessons and innovative STEM lesson delivery.
- STEM careers - available STEM jobs at an international level; how to develop links with STEM businesses
- The effective use of the wide range of educational technology e.g. smart boards, robots, simulations, collaborative software etc.
- How to deliver lessons which are both engaging and interesting to the students. This requires teachers to possess a high degree of knowledge of STEM and regular teacher training.

Provide funding opportunities for qualifying organisations to develop:
- high quality STEM online teaching resources, which can be made available for teachers for free
- videos in relation to STEM careers
- STEM hubs in rural and disadvantaged areas, where professional learning events and other STEM related events can be held to support collaboration and empower STEM teachers

STEM CAREERS

Promote the opportunities and benefits of STEM learning

Involve young people's families with information sessions, recorded webinars, online resources regarding up-to-date STEM career opportunities, pay scales and subject choices. This can also influence young people's choices regarding further education.

Provide funding opportunities for the development of Science Centres within schools or STEM training organisations, especially in rural and disadvantaged areas, in order to promote equal access to high quality science education to all.

Implement a strategy to develop a mobile careers STEM information vehicle. This bus would drive to disadvantaged areas and to areas which lack of STEM teacher expertise.

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2021 - 26 OUTCOMES

TEACHER TRAINING & BETTER TEACHING METHODOLOGIES

2021 - 22 OUTCOME

The project consortium will publish ten high quality, comprehensive STEM lesson plans on the project website in the end of 2021. These lesson plans will support and inspire teachers in order to achieve more in the classroom.

The project will also produce 25 e-modules for STEM teachers as part of their professional development, which will be released in the end of 2021.

We have studied the needs of STEM subject teachers from all over Europe and the content of the e-modules will be developed accordingly.

Through these resources we aim to support STEM teachers continuous professional development (CPD) by providing them with innovative methods for teaching STEM subjects and how to make them much more interesting and appealing for young people.

The lesson plans and the e-modules will be accessible for free via the project's website.

STEM CAREERS

2021 -22 OUTCOME

The project's third main output is the virtual mentoring scheme, which will allow students from the partner countries to engage with STEM professionals within each partner country in order to learn more about their job roles, day to day activities, responsibilities, pay scales and what qualification and experience is required to gain entry to that particular job.

The virtual STEM mentoring scheme will:

- raise students' awareness of STEM jobs
- help students develop a sense of belonging in the new social world of STEM.

Therefore, students will gain a deeper understanding of the type of work involved, what skills are required and an insider's view of what real success means within the industry. Mentors are also likely to have useful tips on how to break into and succeed into a specific career.

2022 - 2026 OUTCOMES

The project consortium will seek the support of stakeholders in each partner country and at a European level, including Educational Authorities, STEM Councils, STEM Training Organisations, Teacher Training Authorities, National Agencies and European STEM Umbrella Bodies such as Science on Stage and EU STEM Coalition.

With the provided support by these influential organisations, the above mentioned long-term goals can be achieved.

More specifically, we aim to:
- Boost a Europe-wide collaboration among STEM teachers, researchers, STEM professionals and policymakers
- Transfer innovative STEM teaching methods to a large number of teachers via the project's e-Learning Area
- Enhance the use of ICT tools in STEM education in order to create a technology-rich learning environment for students.
- Implement mandatory STEM CPD on a yearly basis
- Roll out the virtual mentoring scheme internationally
- Implement the suggestions outlined in this STEM Strategy Action Plan that are beyond the scope of this current project

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.