Recommendations and guidelines for the creation of a Mars-Edu network

Erasmus+

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Executive summary

In order to support teachers in developing the high STEM skills for students needed in the near future, the Schools Tune Into Mars (STIM) project was designed to improve effective and quality teaching of STEM disciplines in secondary education. It also aims to increase young Europeans' knowledge, skills, and interest in STEM education and careers by providing teaching materials related to STEM subjects and developed following a co-constructive process between researchers and teachers targeting planetary seismology and geology, geophysics, Earth and space sciences. Another STIM's main objective is to engage students and teachers with current and real scientific investigations.

To achieve these objectives, Schools Tune Into Mars was initiated as a multi-stakeholder project funded by the Erasmus+ Programme and is a joint initiative of Lycée International de Valbonne, France, European Schoolnet, Belgium, Asociación Española para la Enseñanza de las Ciencias de la Tierra, Spain, and the National Institute for Earth Physics, Romania.

Several complementary activities were developed as part of the STIM project, including:

- Intellectual Output 1[1] : A programmatic document based on STIM resources (e.g. STEM and hands-on activities based on data recorded on Mars, experiments and webinars dedicated to teachers) supported by a study aiming to assess the need and opportunity of STIM resources for teachers.
- Intellectual Output 2[2] : A teaching guide to support the use of resources from space missions in classrooms.
- Intellectual Output 3[3] : A Massive Open Online Course (MOOC) entitled "Bring Mars missions into the classroom", which provides online training to teachers to use innovative teaching materials related to Mars space missions in classrooms.

This publication constitutes Output 4 of the STIM project and presents recommendations targeted to the creation of a new network called Mars-Edu network. This network of science organizations will work on the project's sustainability with the first objective being to develop innovative pedagogical resources related to Earth and Space Science (ESS). These recommendations also aim to inform and to provide advice to educational policy makers regarding the promotion of ESS education.

In its third year of project, STIM focused on identifying key elements to strengthen partnerships between schools and ESS community to support students' learning and engagement.

The following questions were the main focus of interest of the work developed during this year:

- What are the elements which motivate schools to be involved in Earth and Space Science-based learning activities?
- What are the elements which encourage the science community to participate in school activities and partnerships?
- What can we do to ensure the sustainability, scalability and long-time support to an initiative like STIM?

1 available at: https://insight.oca.eu/fr/insight-resources#report
2 available at: https://insight.oca.eu/fr/insight-resources#pedagogical_guide
3 available at: https://insight.oca.eu/fr/stim-resources/8-categorie-fr/insight/562-schools-tune-into-mars-mooc-2

The research carried out under STIM has analyzed the elements that are relevant in creating the network that will allow a high-quality training for teachers in ESS and also provide support to students learning. These elements were identified following a three-steps process:

1. A survey disseminated to educational stakeholders (policy makers, teachers, researchers, teacher trainers);
2. Interviews carried out with heads of schools;
3. Validation of the recommendations during the STIM closing event;

Following this process, the project consortium developed 11 key recommendations for science teachers, heads of schools and policy makers divided into three categories: Professional development, initial training, collaboration, and mentoring.

Recommendations

The recommendations are the following :

Professional development

Recommendation 1: Professional development must focus on current scientific and technological knowledge in the field of space science.

Recommendation 2: Peer to peer learning should be promoted in order for teachers to improve networking opportunities with researchers (like the Mars-Edu network).

Recommendation 3: Online training should be an important component of any teacher education strategy.

Initial training

Recommendation 4: The development of a European framework for ESS is necessary.

Recommendation 5: Initial teacher education courses should help all students' teachers to master innovative classroom practices.

Recommendation 6: Investigate about the causes of disparities among students which have an impact on their orientation should be a priority.

Collaboration and mentorship

Recommendation 7: Mentorship schemes with researchers should be considered as an important way to provide support for teachers to master technologies based on the acquisition and interpretation of research data.

Recommendation 8: The collaboration between teachers and researchers or industry at the local level should be promoted.

Recommendation 9: STEM School's strategies should be developed to develop theSTEM skills required in STEM careers.

Recommendation 10: Promoting the collaboration between teachers and technical to create new pedagogical materials.

Introduction to the survey and interviews

Europe's shortage of a STEM skilled labour force is well documented, and the lack of STEM-skilled labour is predicted to be one of the main obstacles to economic growth in the coming years. Furthermore, most European countries are lagging in international educational studies such as PISA and TIMMS, particularly in areas such as science, mathematics and reading.

In this light, there is a real need for innovative approaches increasing the motivation of pupils towards STEM subjects and for offering teacher training into new ways of introducing science in the classroom. Additionally, there is still much work to be done in improving the image of scientists at the societal level. Initiatives that help demystify science and which connect pupils with real scientists can create a long-lasting positive impact with regards to the image of inaccessible scientists. Moreover, connecting schools with the world of research is essential in ensuring that the research sector will benefit of much needed new talent in its various fields, and that students are thought to think like scientists, weighing evidence to draw conclusions, and learning how to navigate the claims and counterclaims bombarding us in our everyday lives (a crucial need identified through OECD's PISA 2015).

In this regard and following the work carried out by STIM, key elements were identified to strengthen partnerships between schools and the Earth and Space Science (ESS) community to support students' learning and engagement. These elements were identified following a three-steps process:

1) A survey distributed to educational stakeholders (policy makers, teachers, researchers, teacher trainers)

This survey (available in Annex 1) was developed in July 2021, translated in four languages (French, English, Spanish and Romanian) and was disseminated in November until the end of January 2021. In February 2021, 158 responses were collected from Primary school - Secondary school - high schools - Department of Education - University stakeholders coming from 3 different countries (France, Spain and Romania). The results were analyzed and discussed among the consortium in parallel with the interviews carried out with heads of schools in France.

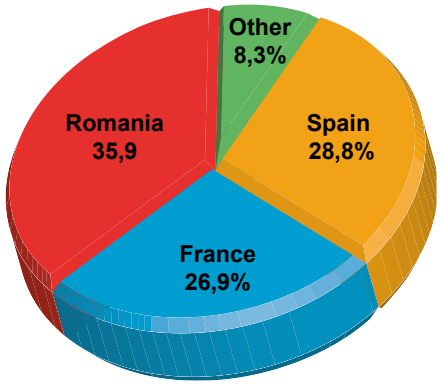


Figure 2: country of origin from respondents

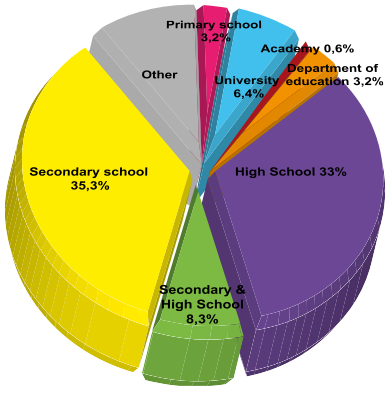


Figure 1: organisations representation from respondents

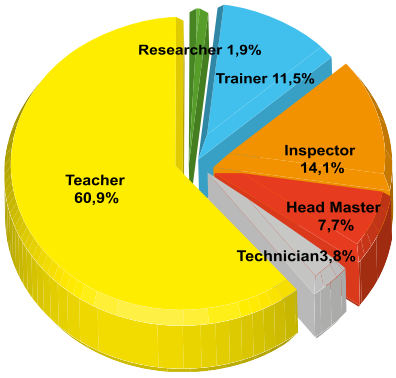


Figure 3: Profession of respondents

2) Interviews carried out with heads of schools

In 2021, the Lycée International de Valbonne (France) carried out interviews with 35 heads of schools in France (secondary education) in order to see if collaborative projects targeting ESS were being developed at the school level and if not which were the obstacles to leading such projects for teachers.

In this regard the interviews included the following questions:

- Do you have teachers involved in collaborative and interdisciplinary projects related to ESS teaching?
- What are the obstacles to implementing such collaboration at the school level regarding ESS teaching?
- Do you have specific professional development needs in order to implement such initiative in your school?
- What are the obstacles to building collaborations between schools and industries?

Following these interviews, it was highlighted by respondents that ESS teaching remains a difficult topic which is barely tackled in secondary education, due to several reasons. Among the ones mentioned, the difficulty of the topic, the necessary material needed and the lack of training were highlighted. Most respondents also indicated that there was a clear need for professional training for teachers regarding 21st century skills in particular to STEM. Finally, it was also found from these interviews that more collaboration was needed between researchers and the educators but also with the industry.

3) Validation of the recommendations during the STIM closing event

On the 11th of June, the STIM closing event was organised in Valbonne with STEM education stakeholders, among which teachers and researchers from the project's countries and other international participants, including policy makers, teachers, representatives of schools, teacher training institutes, and others. The one-day event offered interactive sessions with researchers and representatives from universities, schools, and industries. The event included a session dedicated specifically to discuss the necessary conditions and types of practices leading to effective implementation of ESS in schools. This session was aimed to validate and complement the draft recommendations and agree on the final ones.

C Professional development

As OECD's comparative review on teachers noted (OECD, 2005): effective professional development is on-going, includes training, practice and feedback, and provides adequate time and follow-up support. Successful programmes involve teachers in learning activities that are similar to ones they will use with their students, and encourage the development of teachers' learning communities. The development of teachers beyond their initial training can serve a number of objectives (OECD, 1998), including:

- to update individuals' knowledge of a subject in light of recent advances in the area;
- to update individuals' skills, attitudes and approaches in light of the development of new teaching techniques and objectives, new circumstances and new educational research;
- to enable individuals to apply changes made to curricula or other aspects of teaching practice;

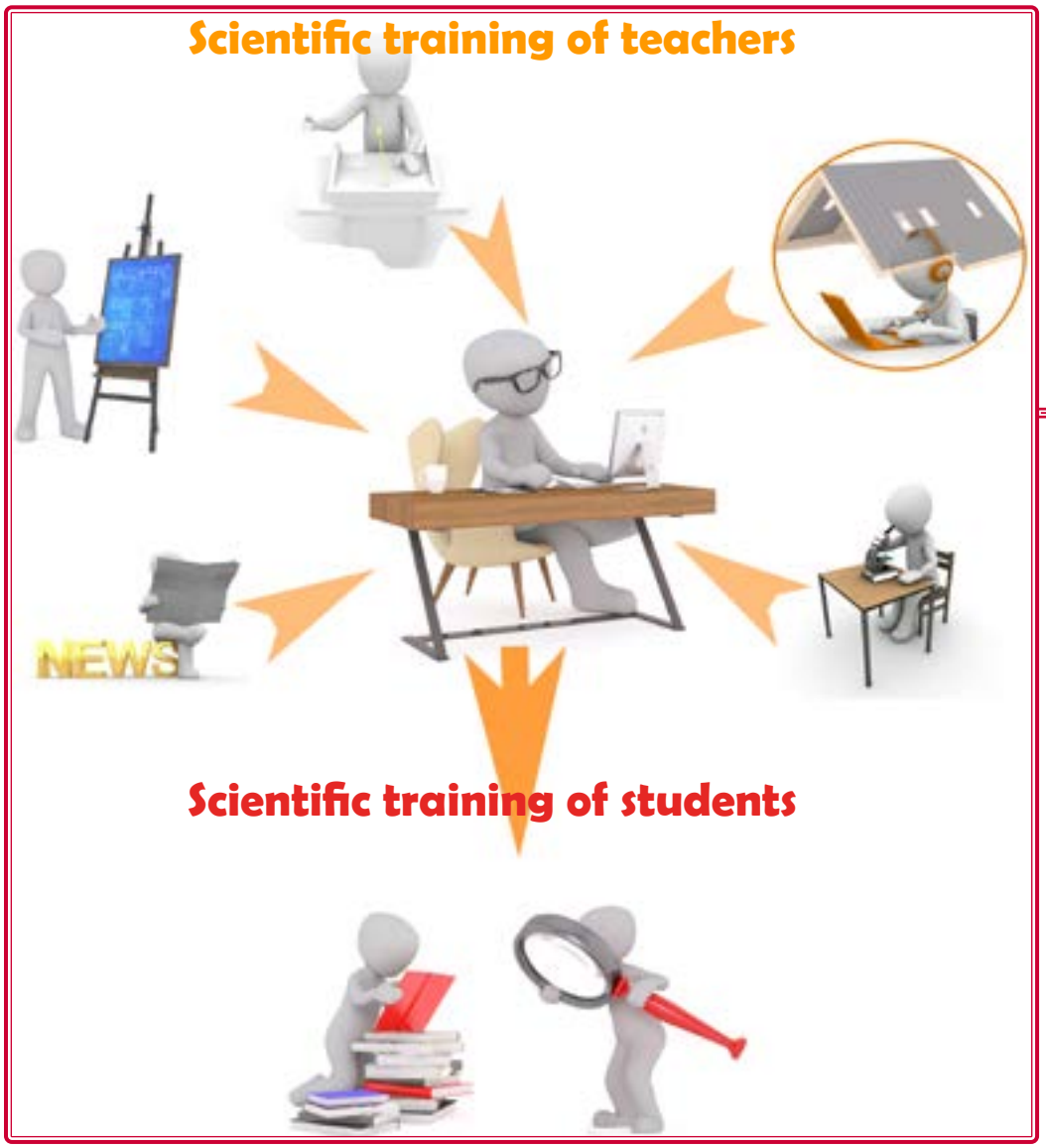
- to enable schools to develop and apply new strategies concerning the curriculum and other aspects of teaching practice;
- to exchange information and expertise among teachers and others, e.g. academics, industrialists; and
- to help weaker teachers become more effective.

Recommendation 1 Professional development must focus on current scientific and technological knowledge in the space field

Introduction

One of the main objectives of the STIM project, also in line with the recommendations of the Committee on Education of the European Geosciences Union (EGU), is “to spread first-hand scientific information to science teachers of secondary (and primary) schools, significantly shortening the time between discovery and textbook, and to provide the teachers with material that can be directly transferred to the classroom”.

Recent investigations[1] have shown that the best way to improve the scientific knowledge of secondary (and primary) students is to improve the knowledge of their teachers. Following these guidelines, the STIM project provides relevant training activities for teachers focused on the most recent progress in the field of space science and technology.



1 For example: King, C, Gorfinkield,G., Frick, M. (2021): International comparisons of school-level geoscience education– the UNESCO/IGEO expert opinion survey. International Journal of Science Education 43-1. 56-78.

In this regard and in order to support this professional development needed for teachers, during its first two years, Schools Tune Into Mars (STIM) has developed and tested successful online resources for teachers developed in collaboration with researchers and following the current scientific knowledge:

- 8 webinars[1] ,
- 8 edu teasers[2] ,
- a Massive Online Open Course (MOOC)[3] targeted to secondary education teachers and any stakeholders interested in bringing Mars missions results in the classroom ,
- 23 number of learning scenarios related to activities directly applicable in the classroom. Most of them can be performed with students not only in the classroom and/or the laboratory, but they can also be used in online sessions [4].

A Website containing conferebces with researchers, STEM activities and other educational resources in «Earth sciences &

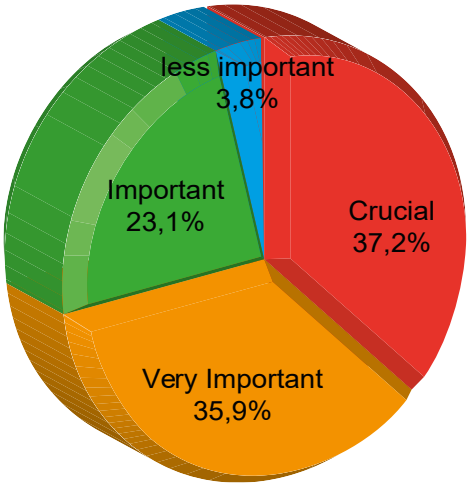


Figure 4: opinion of respondents regarding the importance of a website on EES

Besides, 73,1% of the respondents found it crucial or very important for their continuous professional development (CPD) to have access to a well-designed website. In this regard, the STIM website (https://insight.oca.eu/fr/stim-resources) links all the online activities listed above and should be promoted and disseminated for years to come after the end of the STIM Erasmus+ program.

Moving forward

The training courses for secondary school teachers are strongly in demand and teachers show a remarkable interest in projects such as STIM which promotes an interdisciplinary and global way of learning. However, many participants in training courses for teachers mention that they are not aware of the range of courses available (they do not know that this initiative exists) or they don't have the time to train themselves. To capitalize on the benefits of ESS related activities, ESS should be rooted in education and professional development strategies. It is therefore vital for ESS teaching to be anchored in education and science innovation policies to be considered legitimate, acknowledged as valuable scientific practice, and granted means to materialise and follow the current research process.

1 available at: https://insight.oca.eu/fr/insight-resources#webinars
2 available at: https://insight.oca.eu/fr/insight-resources#eduteaser
3 available at: https://insight.oca.eu/fr/stim-resources/8-categorie-fr/insight/562-schools-tune-into-mars-mooc-2
4 available at: https://insight.oca.eu/fr/stim-resources

Recommendation 2

Peer-to-peer learning should be promoted for teachers to improve networking opportunities with researchers (like the Mars-Edu network).

Introduction

One of the most documented and studied connections between science teaching and learning is made through reflective practice in field experiences, team teaching, collaborative research, or peer coaching. The teachers involved in testing STIM activities often spoke about the need for a new form of collaboration that fosters “integrated professional development”. This is classically achieved through extensive cooperation between schools, universities, research institutes and other research and education rich institutions.

Other options are to foster peer observation, coaching, and mentoring trainee teachers in either structured or unstructured settings.

The STIM project, through the developed activities, facilitated the organization of study groups and hold less-formal sharing sessions that took place between teachers and teachers-researchers. A European project allows not only to organize reflection and feedback groups at school (national) level, but also to address a European framework, declared to be a great advantage by more than 60% of the respondents of the survey.

Besides, the activities have been tested by teachers and students in the classroom, with most of the teachers and students being novices on the subject (e.g planetology or Arduino technologies). Sometimes students invest more time and develop a deeper involvement with some aspect related to technology and software, and the creation of knowledge is truly a cooperative endeavor. As teachers learn to use technology, side by side with students, their own learning has implications for the ways in which they help students to learn more generally.

Moving forward

One way to support peer-to-peer and collective learning is by developing policies that provide teachers with time to work together and that value collaboration, such as by offering incentives for engaging in collaboration. Providing such support for collaborative learning would lend needed structure.

School and district leaders should also explore developing partnerships with individuals and organizations —such as institutions of higher education or science institutes, local businesses and NGOs —that can bring science expertise and promote the access from schools to specialists in promising domains as the ones from Earth & Space science.

Partnerships that foster expertise, networking, sharing and applying science and technology research findings across different enterprises (e.g. start-ups, SMEs, larger corporations) should be envisaged. Gender, socio-economic and geographical differences should be considered.

Recommendation 3

Online training should be an important component of any teacher education strategy.

Introduction

According to the European Commission's Eurydice report on Teaching Careers in Europe (2018), in most European educational systems (with some notable exceptions, among them Turkey and Denmark), teachers' continuous professional development (CPD) is either compulsory or considered a professional duty (meaning that it is compulsory, but with an undefined number of hours).Additionally, in many educational systems, a certain number of hours or credits in CPD training is required for career progression [1].However, teachers often find that their capacity to develop professionally is hindered by conflicting time schedules, lack of incentives, and monetary considerations (Ainley & Carstens, 2018).

There are various possibilities of online resources which can be offered and that were developed by the STIM project to respond to these challenges (as shown in picture X):

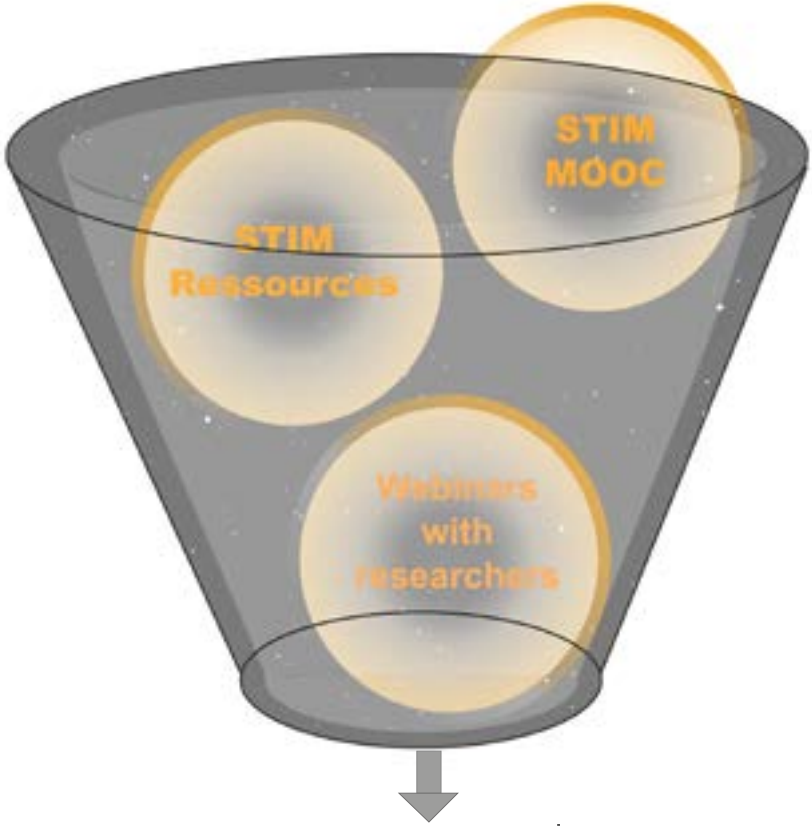


Figure 6 : summary of STIM opportunities for teachers' CPD

In this regard, online training and seminars can play a relevant role in responding to challenges for teachers regarding their professional development. MOOCs, Massive online open courses, for example, respond to these challenges by offering teachers the opportunity to get high-quality focused professional training that is flexible and allows them to build upon their skills to develop in their careers and provide their students

1 Nistor, A., Gras-Velazquez, A., Billon, N. & Mihai, G. (2018). Science, Technology, Engineering and Mathematics Education Practices in Europe. Scientix Observatory report. December 2018, European Schoolnet, Brussels.

Providing oneline training courses containing scintific knowledge,STEM activities tobe carried out with their students and a discussion and peer -to-peer forum for

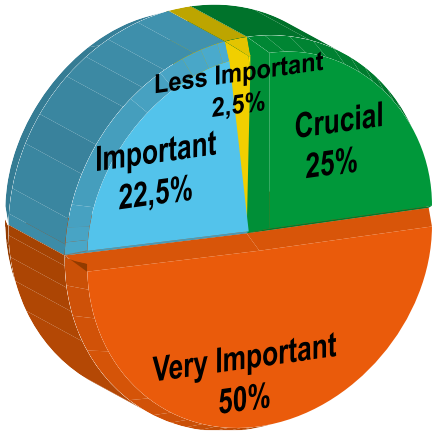


figure 7: opinion of respondents regardingthe provision of oneline training courses containing scintific knowledge, STEM activities to be carried out with students and peer to peer forum for teachers and laboratory technicians

According to the survey results, 75% of respondents indicated that providing online training courses (containing scientific knowledge, STEM activities to be carried out with their students and a discussion and peer-to-peer forum for teachers and laboratory technicians) would significantly contribute to the CPD of teachers in the field of Earth and Space Science (75%). This interest was shown via the participation in the STIM MOOC; 523 participants started following at least one course module, and 230 participants passed the MOOC and received the course certification. The feedback collected from the course via the post-course survey was extremely positive, as 99% participants rated the overall value of the course as “Good” or “Very good”. Besides, 93% of them would recommend the course to a colleague or a friend. Finally, 95% agreed that they now know how to address Mars related experiments and space missions in their practice. In terms of training and CPD, the STIM Project also organised seminars to promote Earth science & Space teaching and, most importantly, the necessary collaboration among teachers in this field. In total 6 webinars were conducted with researchers about Earth and Space Science related topics.

Additionally, 73,1% of the respondents considered that a website containing conferences with researchers, STEM activities and other educational resources in “Earth science & space” would contribute significantly to the professional development of teachers in the field. This interest was demonstrated concretely via the corresponding activities of the STIM project. For instance, dedicated STIM pages were developed through already existing websites that are well known by the STEM education community (Insight.oca and Scientix) collecting hundreds of views/month. Additionally, 35 (educational) resources in “Earth Science & Space” were published in Scientix, including a practical pedagogical guide that aims to provide teachers with the necessary guidelines to implement the activities in their classrooms.

Moving forward

The work done until now in STIM should be further promoted to develop a Mars-Edu network, as promotion and dissemination of the innovative resources created under the project would make them accessible to the general community for science education in Europe. The inclusion and promotion of STIM materials, activities and resources can be achieved via the continued participation in existing collaborative platforms, such as Scientix and e-Twinning. At the same time, this can be sustained via the establishment of proper communication channels for organizations, associations, schools, teachers and researchers working in the field to stay connected. As highlighted by the responses in this survey, the development of a European framework for education in “Earth science & space” (60,2%) was also considered important for participants regarding the fields of Earth and Space Science. Although STIM provided an initial basis for the resources to be integrated into the curriculum and the recommendations for a Mars Edu network at the EU level, further study is needed in this regard for the fields of “Earth science & space” in order to provide teachers with a unifying reference tool dedicated to Earth science & space that would guide them in their teaching practices.

Initial training

Initial teacher education (ITE), or undergraduate teacher education as it is also known in universities, is defined as the entry level qualification that is completed prior to entering service as a teacher[1] .

Recommendation 4 The development of a European framework for Earth and Space Science is important

Introduction

As it can be seen in the graphs below, the majority of respondents of the STIM survey (60,2% of them) suggested that "a European framework for education in Earth Science & Space" would be crucial or very important for the professional development of teachers in the field of Earth Science & Space."

Besides, most of them (65,2%) found it crucial or very important for schools to get involved with STIM because "its activities connect to societal changes".

In addition, many of them (65,4%) indicated that one of the main reasons that could motivate policy makers to promote Earth Science & Space was "to address the deficit of researchers and engineers in Earth and Space Science".

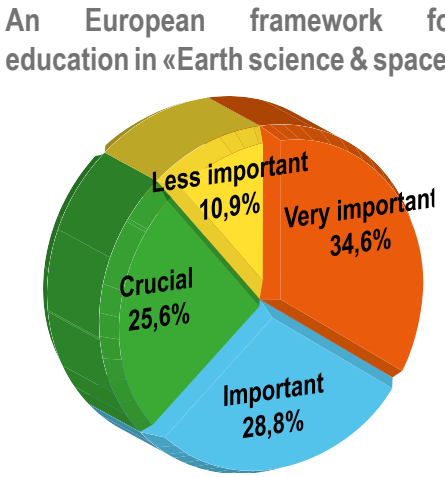


Figure 9: opinion of respondents regarding the importance of a European framework for eduction in ESS

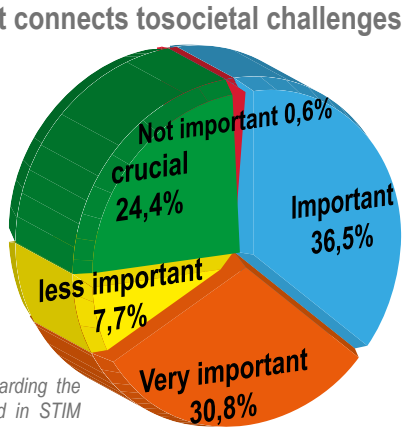


Figure 8 : opinion of respondents regarding the importance for schools to get involved in STIM activities and ESS ones

In order to address these demands from the respondents, it is important that ESS training is included in teacher training. Special attention should be paid to the trainee teachers and newly qualified teachers as they are called to be between the main protagonists of the societal changes to come. Political authorities, in a broad sense, should include not only political authorities at European, national, regional or local levels, but also a wide range of other social actors that are able to influence society. They include educational authorities at universities, colleges, and schools; teachers' colleges; professional scientific associations; science teachers associations; research centers related to STIM disciplines, etc

1 definition from https://archinfos.com/library/lecture/read/100951-what-is-initial-teacher-education

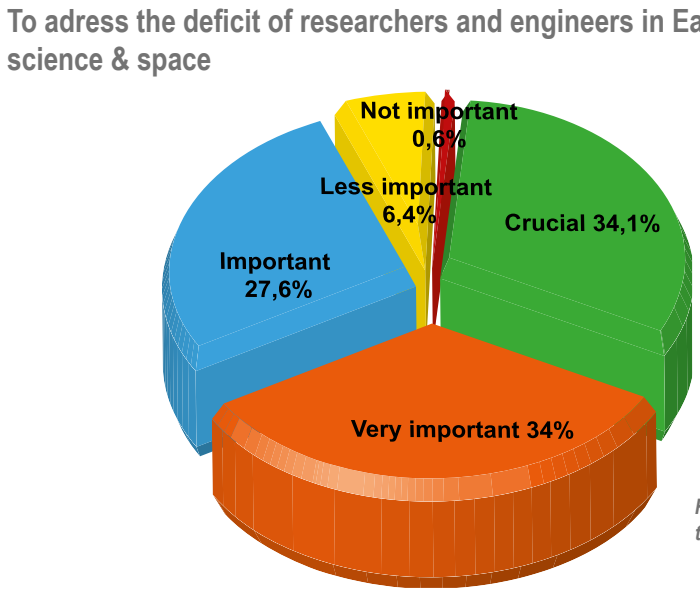


Figure 10 : opinion of respondents regarding the deficit of researchers and engineers in EES

Moving forward

In order to involve the policy makers with STIM activities, several actions should be undertaken:

- Setting communication channels among organizations and associations of teachers and researchers working in learning issues;
- Sharing the STIM activities, resources and materials providing open access to the general public;
- Promoting the collaboration between schools and specialists in Earth science & space in order. This would encourage schools to collaborate with scientists;
- Ensuring the presence and diffusion of the STIM outcomes and materials in congresses, symposia, training courses, summer schools… This will provide STIM partners with opportunities to establish fruitful contacts with relevant stakeholders;
- Enhancing the diffusion of the STIM materials through other similar international organizations and networks.
- This should be not only part of the CPD for all types of teachers, but also an opportunity for trainee teachers and newly qualified teachers to collaborate both with more experienced teachers and researchers.

Recommendation 5 — Initial teacher education courses should help all students' teachers to master innovative classroom practices

Introduction

In education, an innovative intervention must result in improved learning and greater equity. It must also contribute to providing solutions to simple problems and be on the same scale as the problem it is trying to solve (UNICEF).

Innovative teaching is the process that leads to creative learning, through the development of new methods, new tools and new content for the benefit of students.

Developing scientific approach, critical thinking, creativity, curiosity, acceptance of failure and more.

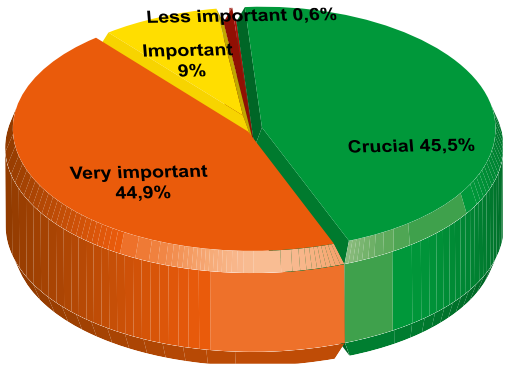


Figure 11: survey resposes to the question «In your opinion, wath is the value of doing STEM approaches to Earth and Space science in the classroom.

In addition to creativity, such an approach to teaching allows students to develop skills such as: problem solving, analytical skills, critical thinking, self-management, communication skills, teamwork, language and digital skills and acceptance of failure which help students to become 21st century citizens

However, 90.4% of those surveyed indicated that STEM education as offered by STIM enables the development of such skills

The integration of innovative practices in the classroom is however not an easy thing, it will require a good management of the classroom group, the knowledge and skills involved but also of the educational materials used.

For such practices the very status of the teacher may be challenged. The teacher will in fact have to «be able to go beyond confrontation with the class group to enter into communication with individual students and adopt a creative approach towards the students' (Martinez). However, for many teachers this type of teaching does not correspond to what they have experienced as learners, which will not facilitate its implementation, which can then be considered as risk-taking. It therefore seems essential for future teachers to be trained in innovative classroom practices but also to experience such situations themselves, as students in pedagogy, in order to better understand the benefits.

On the other hand, the teacher who engages in such practices must necessarily master the knowledge involved in learning.

However, knowledge in the fields of planetology and planetary seismology are directly linked to scientific progress and to advances due to the various space missions. It therefore seems essential to maintain the level of knowledge of teachers who, for the majority of the panel surveyed, are already trained in this field during their initial training. In order to enable teachers to update their knowledge, those questioned on this subject stated that online conferences by researchers would contribute to their professional development. Such conferences are available on the Insight Resources website (oca.eu).

Providing online training courses containing scientific knowledge, STEM activitiesto be carried outwith their students and a discussion and peer-to-peer forum for teachers and laboratory

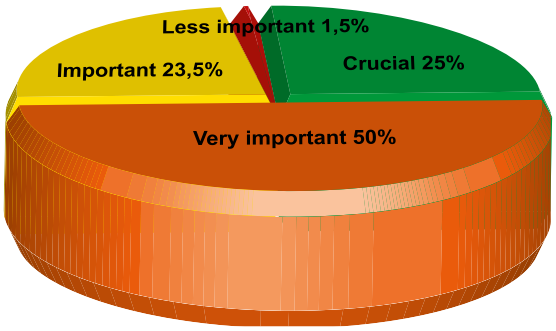


Figure 12 : survey response regarding the question : what would yousuggest to contribute significantly to the professional development of teachers in the field of Earth science and space.

The organisation of workshops, as carried out in the STIM project, with scientists and teachers, obviously answers the expectations of teachers, allowing both an updating of knowledge and an exchange of practices.

Nevertheless, being aware of the difficulties linked to health constraints, the respondents agree that online events such as «teachmeet» can also enable the exchange of practices, as in the case of the MOOC carried out under the project, or the sharing of centralised activities on a website as proposed on the Insight Resources website (oca.eu). In addition, the use of these online channels also benefits newly qualified teachers and trainer teachers.

While scientific advances have made it possible to increase knowledge in the fields of planetology, they have also made it possible to provide tools to increase the creativity of learners and teachers.

Future teachers must therefore be trained in these new tools, which are mostly ICTE-related but can also be more technical, such as the use of microcontrollers. The provision of resources such as technical data sheets will enable a better understanding of these new tools.

The STIM project makes available within its pedagogical guide technical data sheets allowing the greatest number of people to work with the software used in the proposed activities as well as the manufacture and use of sensors associated or not with microcontrollers. This last material allows creativity and freedom of experimentation in the field of science. Training or at least awareness-raising among young teachers is essential in order to familiarize them with these new technological tools so they can use them more frequently.

Moving forward

The teaching of ESS is therefore, as the resources produced by the STIM project prove, an education that allows for the implementation of innovative teaching practices. However, it should not be overlooked that these practices can place untrained teachers in difficulty. It is therefore essential to challenge and raise the awareness of future teachers, during their university courses, with this type of practice in order to encourage them and give them the means to implement them in their future classes. Similarly, they should be given the opportunity to update their knowledge, whether in the scientific or teaching field, by making targeted and centralised resources available.

To contribute to the professional development by updating teachers' scientific and technological knowledge in Earth sciences and space.

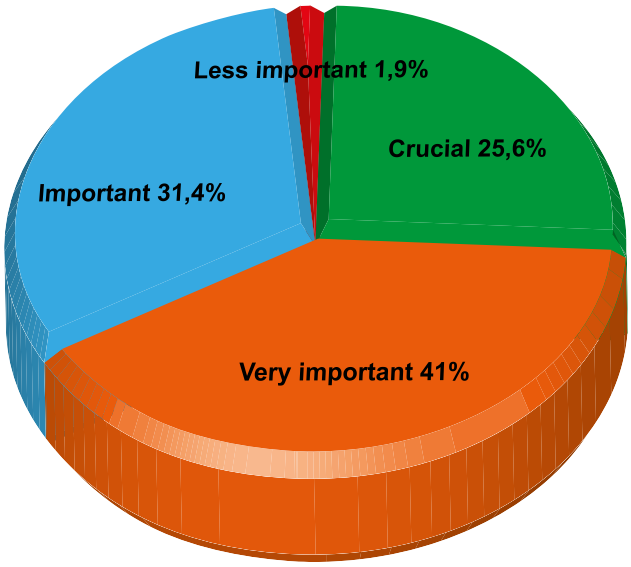


Figure 13 : opinion of respondentsregarding the importanceof updatingteachers'scientific and technological knowledge in Earth science and space

Recommendation 6

Initial teacher education courses should help all students' teachers to master innovative classroom practices

Although in recent years there has been a predominance in the school performance of girls compared to boys, even in good grades and in courses identified as 'masculine', such as Mathematics and Physics, gender differences as far as preferences and the choices of school subjects are concerned, still exist[1] .

Thus, girls tend to focus mainly on 'theoretical' subjects such as arts, while boys focus mainly on 'practical' subjects such as Physics, Computer Science and Technology (Arnot et al., 1999; Colley & Comber, 2003; Colley, Comber, & Hargreaves, 1997; Francis, 2000; Lightbody, Siann, Stocks, & Walsh, 1996). Besides, in the field of engineering and scientific research, women still have little or no presence, as shown in picture X below. Indeed according to Eurostat in 2018[2], from almost 15 million scientists and engineers in the EU, 59% were men and 41% women.

For the question «In your opinion, why is it important for schools to get involved in Earth Science & Space based learning activities?», 82,7 % of the respondents indicated «to increase girls' interest in Earth Science & Space

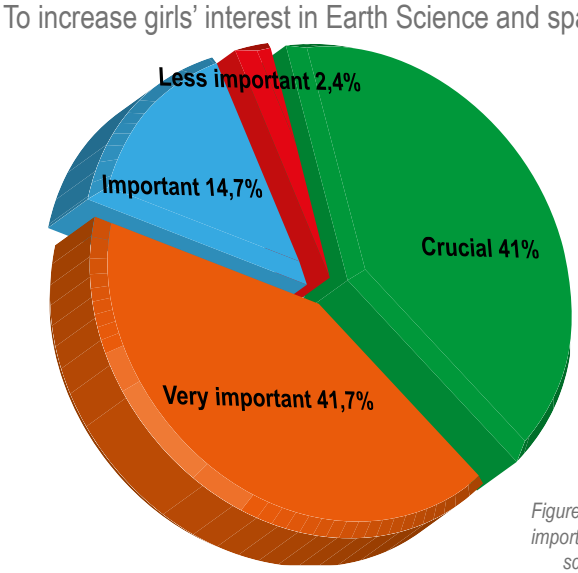


Figure 15 : opinion of respondentsregarding the importance for schools to get involved in Earth science and space besed learning activities

1 Spiliopoulou, G., Koustourakis, G., & Asimaki, A. (2018). The Impact of Gender Differences on the Formation of Young People's Aspirations/Expectations and Choices For Their Educational and Occupational Future: A Review of Sociological Scientific Literature. https://doi.org/10.46827/EJES.V0I0.1734

2 Source dataset: hrst_st_nsecsex2

Increasing girl's interest in ESS can be done via different strategies at the teacher's level:

- **Break down the stereotypes**: According to Laurie O'Brien, a psychology professor at Tulane University told The Atlantic, "One of the biggest issues with how most people think about stereotypes—they think it's intentional. But actually, if you don't do anything, you will hold stereotypes, and it's something you have to fight against, especially as educators." For example, as NBC News explained, "Teachers often interact more with boys than with girls in science and math. A teacher will often help a boy do an experiment by explaining how to do it, while when a girl asks for assistance the teacher will often simply do the experiment, leaving the girl to watch rather than do." Breaking down the stereotypes that are responsible for the barriers that prevent girls from choosing scientific fields is therefore important. In this regard, this is why it is important to choose subjects that have always fascinated human beings like «the discovery of the planet Mars» . For example, following a mission like Insight Mars or Mars 2020 where parity is respected can really inspire students to pursue new career pathways. Indeed, the Insight mission team is made up of 120 women out of a total of 440 scientists, which is a very high percentage for a science team in the field of planetology.

- **Promote Project-based learning**: In a project-based approach to learning, students are first presented with a real-world problem or issue and then learn the content necessary to answer questions they have derived in response to the problem. During this scientific process students build the problem solving, project management, collaboration, and leadership skills necessary for success in the world beyond the classroom as boys. In this regard, proposing to the girls to be ambassadors of their scientific project can increase their interest in ESS. Another option could also be to give them the opportunity to lead the group and provide them with responsibilities so they can increase their confidence in taking up scientific careers. Indeed, being an active participant in one's own learning is essential to build confidence and thus project oneself into school careers which seem more «demanding» to them[1] .

- **Introducing new perspectives**: For the question : In your opinion, what is the value of doing STEM approaches to Earth and Space science in the classroom? 78,2.7% of the participants in the questionnaire answered that it is especially important to enable girls to discover new perspectives on career development by introducing new skills. In this regard, schools could contribute by organising field trips, work experience or career days where students and specially girls can learn about how researchers work in STEM industries.

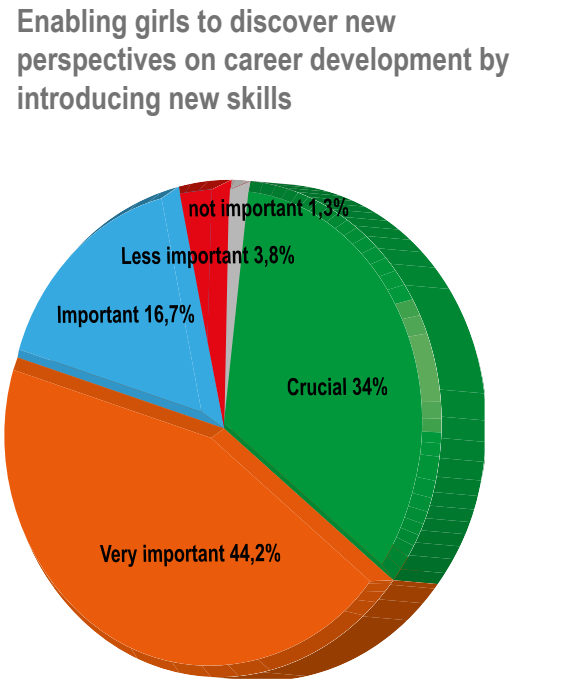


Figure 16 : opinion of respondents regarding the value of doing STEM approaches to ESS in the classroom

1 This is what emerges from the testimony of the high school girls who participated in the STEM project, you can see the short video of their interview «STEM by girls»: https://insight.oca.eu/fr/insight-resources#eduteaser

Moving forward

Based on the aforementioned it is important to note that teachers have his role to play to bust those stereotypes via the following actions for example:

- Encourage girls to use computer languages such as Python, arduino in their investigations.
- To enhance the diversity of the groups when setting up the workshops.
- Fostering cooperation between girls and boys through innovative classroom practices
- Encourage the participation of the most backward girls and balance the speaking out.

In order to move forward, It is however necessary to identify the causes of these disparities with parents, pupils, the educational world, etc. between students in order to impact better students orientation

Collaboration and Mentorship

Cooperation and collaboration may appear to have the same meaning. However, they are not equivalent. In recent times, the term collaboration has gained relevance within many institutions, including the educational ones. This has led collaboration to be not only a value, a goal, a skill but also the first step towards implementing a new culture of working together. As a summary, when several people collaborate among them, they learn from each other. Mentorship is the activity of giving a younger or less experienced person help and advice over a period of time, especially at work or school.

Recommendation 7

Mentorship schemes with researchers should be considered as an important way to provide support for teachers to master technologies based on the acquisition and interpretation of research data.

Introduction

More and more, studies[1] prove that achievement in school also depends on what happens outside of school. Bringing students and teachers in contact with the broader community can enhance their learning. Universities, research institutes, other educational organizations and even businesses have helped communities to upgrade the quality of teaching in schools. Projects developed in such partnerships have begun to truly identify educational needs and to explore the opportunities they can create that prove their impact in the short, medium and long term.

STIM project is representative of such innovative partnership, with researchers playing an important part in both product creation and implementation activities, often playing a mentoring role with teachers.

1 National Research Council 2014. STEM Integration in K-12 Education: Status,Prospects, and an Agenda for Research. Washington, DC: The National AcademiesPress. https://doi.org/10.17226/18612.

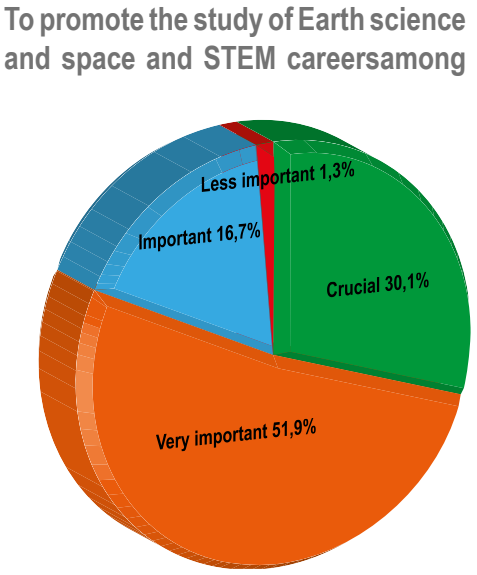


Figure 17 : opinion of respondents regarding the promotion of EES students and STEM careers among students

According to the STIM survey, teachers validate that school involvement in Earth and Space Science based learning activities is important to promote the domain and STEM careers associated with it (82,0%). Also from respondents' point of view, it is important for the science community to participate in school activities and partnerships related to Earth and thus contribute to professional development of teachers by updating their scientific and technological knowledge on the subject (78%).

STIM makes full use of the technologies based on the acquisition and interpretation of different sets of research data, some of them for the first time directly available for education (e.g: recordings from the Insight project). These data have been put in a technological context and when teachers learn to use such a new technology in their classrooms, they model the learning process for students, gaining new insights on teaching by observing how they learn. In this collaboration, the mentor and teacher role naturally transfer in the learning process, most of the time spontaneously. Facing a new fact, even if both teachers and students are novices, sometimes the latter invest more time and develop a deeper involvement with some aspects of the technology and software, and the creation of knowledge is truly a cooperative endeavor.

Researchers play an important role in this cooperative participation contributing to an intense cognitive motivation for all the players involved in the process. But mentorship, as in most of the cases, should be regarded as a long-term guidance tool. Teachers must be offered and be constantly involved in high-quality and coherent professional learning experiences that model teaching and learning through investigation and design. The strategy that focuses on mentorship schema needs to be implemented at management school level but also be regarded as normal investments by the research community that need to provide tutors, mentors, internships, and service-learning experiences.

Moving forward:

A model tested during the STIM project and recommended to be followed is one that integrates intensive summer research experiences with teacher preparation to create teachers who see themselves as both teachers and researchers, or as “teacher–researchers”. Analyzing the data regarding the ages and experience of the teachers participating in the STIM training sessions, such initiatives are absolutely necessary and regarded as being able to make a difference especially at critical early junctures in a teacher’s professional development.

Recommendation 8

The collaboration between teachers and researchers or industry at the local level should be promoted.

The smooth transition of students into higher education or employment is still not fully achieved in our societies. To enhance the pursuit of STEM studies and careers that ensure employability and competitiveness, it is necessary for the actors involved with STEM to collaborate tightly (European Commission, 2015). For this reason, formal, non-formal and informal educational institutions and educators should cooperate with research centres, companies, enterprises, industry, and civil society. This multi-stakeholder collaboration will not only imply heightened possibilities for schools to teach, and students to learn, knowledge and skills applicable in real-life contexts. It will also ensure the relevant and meaningful engagement of non-strictly educational actors with schools and pupils.

Innovation in education requires iterative interactions among these actors to co-create knowledge and introduce real-life challenges and problem-solving skills in a classroom setting. The application of school learning and teaching to real-world problems, happening through research and industrial partnership, can help students (and teachers) understand the relevance of what is taught in class and stimulate the desire to work in a specific field. This last point is particularly relevant when thinking in terms of levelling out the gender gap in STEM.

The findings of the STEM Education Policies in Europe report highlight that educator appear to be open to school-industry collaboration – a positive sign, as school-industry exchanges can provide valuable opportunities for teachers to develop professionally. As the previous recommendations highlight, teachers' CPD is crucial to the uptake of STEM knowledge and practice among students. Only when teachers are trained, they can use relevant technologies, pedagogies, and concepts. Moreover, the report shows that STEM industries are increasingly involved in actions that support teachers to produce educational content. However, STEM teachers report rare use of industry-based educational materials, an indication that their general openness towards collaborating with STEM industries is not met with an appropriate response. Strengthening school-industry collaboration is essential to ensure that teachers are in a good position to help their students develop relevant skills and that companies can support the improvement of the labour force of tomorrow.

A valid example of successful cooperation is the STEM Alliance. The STEM Alliance brings together industries, Ministries of Education, and education stakeholders to promote STEM education and careers to the youth and addresses anticipated future skills gaps within the European Union. For example, through the STEM discovery campaign, the STEM Alliance promotes STEM education and careers across Europe. The initiative helps to train a skilled European workforce for STEM, and it fosters innovation in schools. Regional authorities should promote partnerships, also in light of fostering regional competitiveness through education-industry clusters, and the provision of coherent skills, training and competences to pupils.

The relevant role the STIM project can play in the school-industry-research partnership emerges from the survey carried out. Indeed, 75% of the respondents believe that the in-class combination of STEM approaches and Earth & Space science can favour students to find out more about science-related jobs. This is particularly true for girls that, through this combination, can approach career development from different perspectives, as they are introduced to new STEM skills - an opinion supported by 78,9% of respondents (see Figure 19).

Similarly, four out of five respondents argue that schools that are involved with those activities promoted by STIM, i.e. based on Earth & Space science, can in turn support the study of STEM disciplines as related to Earth & Space, and STEM careers.

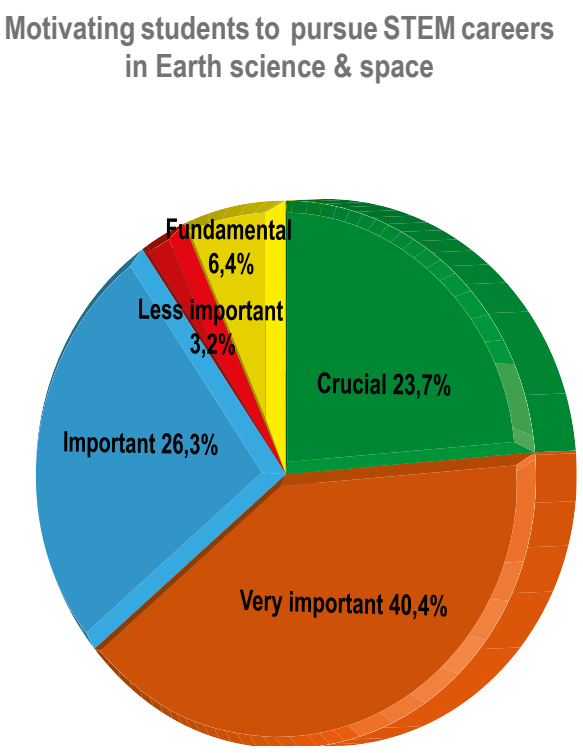


Figure 19: opinion of respondents regarding the importance of motivating students to pursue STEM careers in Earth science & space

Finally, when asked about the relevance of science community partnership in schools and educational activities as it relates to Earth Science & Space, three quarters of the respondents perceive the value of bringing together professionals and schools. On the same topic, 70,5% believe that partnerships will provide students with exemplary, positive and realistic demonstrations, and enhance the pursuit of STEM careers in the field of Earth Science & Space. Hence, establishing partnership can enhance the uptake of STEM-related academic and educational careers.

Moving forward:

STIM should promote initiatives like the STEM Alliance to favour activities linking formal education with industry and research centres. Many possibilities exist to bring research and industry inside classrooms for what concerns Earth Science & Space Education. Indeed, the STIM project can facilitate schools contacting and setting up meetings with relevant figures in the field, whose inspiring academic and career paths can involve pupils with the topic.

Recommendation 9

STEM School's strategies should be developed in accordance with the STEM skills required in STEM careers.

Across European countries, STEM education has become a priority, and various initiatives were developed in the years to reach appropriate levels of STEM literacy, teaching and learning, also in response to the gap between students skilled to pursue STEM careers and the rising demand of professionals in the field, as highlighted in PISA 2018 (European Commission, 2019). The shortage of future STEM professionals requires relevant national authorities to devise, and foster, strategies to improve the performance of students and teachers on STEM. Besides individual teachers training, the entire school structure could and should provide adequate STEM strategies and plans to shape the STEM learners and workers of the future.

In this regard, it is of utmost importance for schools and school leaders to have access to self-evaluation tools that can help them to pinpoint the strengths, weaknesses and potential of their institutions for them to work on improved strategies. In other words, a valid strategy would be the definition of STEM certifications for schools. Drawing from the experience of EUN with the STEM School Label project, STEM schools are gaining more and more momentum across Europea. A STEM School is defined as a school with a clear STEM strategy and "actively promoting and fostering creative, formative science and technology classroom practices and collaborate intensively with [...] universities, research laboratories and various companies" (Jimenez Iglesias et al., 2018).

Schools that aim at properly fostering STEM education should cater for, amongst others, an inclusive culture; ongoing collaboration with the community, other schools, and industry professionals (as proposed in the previous recommendation); high-quality materials; specialised STEM curricula; interdisciplinary instruction; project-based learning; and CPD. The STIM resources actively contribute to the development of a STEM strategy at the school level by proving interdisciplinary approaches that link science education with real-life concerns, problems and scenarios. This way, STIM sustains the development of STEM skills for STEM careers in schools. The project contextualises STEM teaching for the field of Earth & Space thanks to its high-quality lesson plans and the MOOC, useful for students' instruction and teachers' professional development. Additionally, the plans favour the teaching of science education in classrooms across Europe without the need to change the curricula. STIM also promotes a culture of inclusivity since it focuses on bridging the gap of female participation in STEM.

Delving deeper into STIM, from the survey, it emerged that teachers see the value of STEM approaches to Earth and Space science in terms of promoting the skills students need for science careers students (78,9% of respondents found it very important or crucial). Additionally, to 78,2% of the respondents, STEM approaches enable girls to discover new perspectives and opportunities for career development by introducing them to new skills in Earth & Space Science. In general terms, 75% of all teachers believe that introducing STEM in Earth and Space Science classes help students in discovering more about scientific professions.

Concerning respondents' opinion on the relevance for schools to become involved in Earth Science & Space based learning activities, the highest percentage of respondents, 82%, believe that the significance of the involvement of schools lies in promoting the study of Earth Science & Space and STEM careers. Moreover, almost two-thirds of the respondents (65,2%-Figure 20) underlined how Earth Science & Space based learning activities in schools help to make the connection with societal changes.

Besides, 70,5% of all respondents believe that it would be relevant for the science community to engage in school activities and partnerships related to Earth Science & Space, especially because it can motivate students to pursue STEM careers in the field. And indeed, 65,4% of respondent teachers argue that what pushes policymakers to support and promote Earth Science & Space based learning activities is to address the deficit of researchers and engineers in Earth Science & Space. From the survey responses, other reasons for policymakers to become involved with the promotion of Earth & Space Science, lie in training girls in the field and creating knowledge around space and planets.

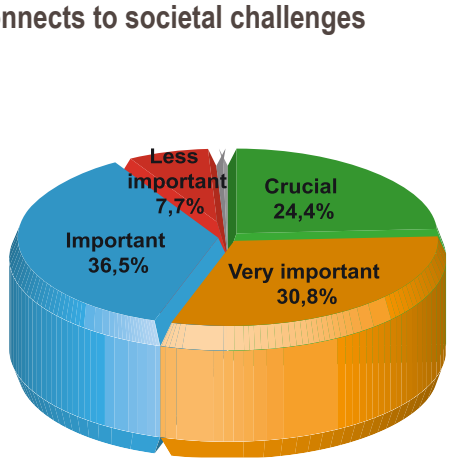


Figure 20 : opinion of respondents regarding how STIM activities connect to societal challenges

Moving forward:

STIM outcomes and outputs can strongly support the development of STEM strategies and action plans in schools. For example, the STIM MOOC fosters teachers' professionalization, and the STIM learning plans offer attractive and interactive materials to engage students on STEM topics and their application in real contexts. Additionally, STIM supports teachers in implementing these materials in class, providing pedagogical guidelines. For this reason, STIM activities should be adopted in schools across Europe and beyond.

To further support the establishment of STEM strategies and action plans in schools, the STIM project will have to favor the connection between schools and Earth and Space Science specialists that the project can reach and gather in a network. Indeed, schools can benefit from the access to professionals connected to STIM as their advice, expertise and experience can sustain the development of interest, passion and skills for STEM higher studies and careers amongst students.

It is almost self-understanding that communicating the results of STIM is the preliminary step to enhance Earth Science & Space based knowledge and activities in schools, thereby achieving the objective of developing STEM strategies. A strong presence of STIM in existing networks and on social media can help to promote space education and the educational materials and professionalization tools that support this form of education.

Recommendation 10

Encourage collaboration between technicians – teachers to develop innovative supports.

Introduction

Practical work is proven to be an effective, versatile tool that teachers can adapt and apply, into science lessons, to meet student's specific learning needs. Even so, one of the causes repeatedly mentioned by teachers as an obstacle in implementing practical activities in schools is the lack of resources and especially the lack of time needed to prepare these activities.

It was observed that school programs focused on practical activities are specific of school systems that have in their organization chart the positions of technicians in support for teachers. Technicians are an important part of any education team and play a particularly vital role in promoting practical science to students. Technicians play a crucial role particularly in school science departments by demonstrating, advising and setting up practicals. They also guarantee the continuity of knowledge of experiments, practical skills and correct equipment usage. Also, by participating in educational pilot projects they can test and validate the appropriateness of some activities for their school curricula and (if existing) STEM school strategy.

Technicians can also play an important role in teachers training, especially young ones, in the early years, assuring a smooth transition for the students and maintaining best practices.

Despite their external and internal recognition, they are decreasing in number, one of the main reasons being that their profile and professionalism is underrated and unacknowledged by non-science school staff. Besides there is also a lack of professional development opportunities and involvement in projects, side by side with the teachers they support.

To address the deficit of researchers and engineers in earth science & space.

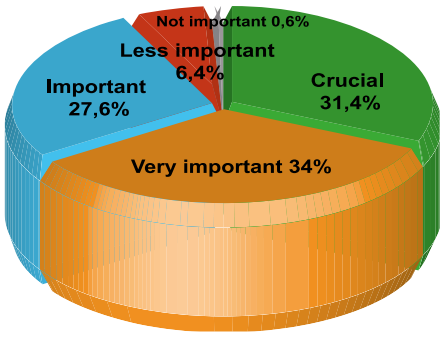


Figure 21 :opinion of respondents regarding the deficit of researchers and engineers in earth science & space.

According to the STIM survey, teachers have been suggesting the implementation of good technical support, as a resolution for inadequate supplies of expertise within science departments. This result is in direct correlation with other results revealed by the survey: the need for CDP and teacher training in support for activities that promote skills needed in science careers for students.

Under STIM, technicians have been involved in each stage of the project, being an integrated and essential part in the development and implementation of all the produced activities.

The fact goes hand in hand with the deficit of researchers and engineers in Earth & Space Science domain, at national but also European level. The latter statement is indeed mentioned by respondents of the STIM survey as a fact that should convince policymakers to promote Earth Science & Space based learning activities in formal and nonformal educational environments.

Moving forward:

A sustained advocacy program on the role and impact of technicians for school activities and STEM strategy implementation is therefore necessary. Alongside with the above statements, other benefits coming directly from technician roles and duties can also be considered (e.g more flexibility to manage workloads, not confined by lesson timings, health, and safety considerations at the core of their actions). Documents like the present report could be extremely helpful and can bring evidence in this regard.

Another option considered is to set as specialization courses taught by experienced technicians for young teachers who teach scientific and non-scientific disciplines. This is also due to the fact that the new inter and transdisciplinary approaches imply the collaboration between teachers of different disciplines, implicitly a basic level of knowledge on the subjects, in order to be able to discover the possible connections and to be able to highlight them. A more structured approach is needed to produce results at a larger scale, but a start could be considered on a pilot project.

Conclusion

According to the consultations and interviews presented previously, to effectively develop ESS strategies in schools, teachers would greatly benefit from having more detailed information and guidance on ESS teaching strategies and opportunities of collaboration.

Responding to the bottlenecks identified under the STIM project, the consortium has formulated recommendations on a wide range of topics and included some of them specifically focused on continuing professional development of teachers (recommendation 1,2 and 3). Teacher education is indeed key for successful integration of ESS in schools, but this training must include also initial teacher education and not only on-going, 'lifelong' professional development opportunities throughout all stages of a teacher's career. Providing teachers with the knowledge and competences they need to make use of ESS practices is a core issue for policy makers related to the digitization of schools. As well as developing effective CPD programmes that improve the digital competences of all teachers, it is important that policy makers also look for ways to work with Initial Teacher Education (ITE) institutions in the region to ensure that corresponding strategies on ESS are adopted to provide mandatory training for newly qualified teachers. The provision of such competences to both pre-service, newly qualified, and experienced and their training on the pedagogical use of ESS practices in the classroom will therefore certainly be part of discussions and research beyond the duration of the project.

ANNEXE 1: STIM - Recommendations for the creation of a Mars-Edu network- questionnaire

This survey is part of a project Erasmus+ - School Tune into Mars (STIM) - that aims to strengthen partnerships between schools and the Earth and Space Science community to support students learning and engagement.

The objective of the survey is to get the opinion of the science teachers, heads of schools and Policy makers in order to better address their needs and interest and to develop recommendations which aim to contribute to a specific network for Mars education projects.

This network will aim to strengthen professional development opportunities for teachers.

This survey is addressed to different profiles: decision makers, heads of school and teachers.

The deadline for completing the survey is November 29th, 2020. The data collected will be deleted after 36 months.

The estimated duration for completing the survey is about 10 minutes.

THANK YOU FOR YOUR TIME AND COLLABORATION

DATA PROTECTION AND PROCESSING:

The personal data collected through this survey will be used strictly in line with the objectives defined above. Personal data (first name, last name, email address, school name, address) collected via this submission form will be used by the Lycée International de Valbonne (LIV), EUN Partnership AISBL, the Asociación Española para la Enseñanza de las Ciencias de la Tierra (AEPECT) and the National Institute for Earth Physics (NIEP) with the purpose of contacting you in case of issues with your submission or regarding project opportunities. Other data, related to your activity will be published as stated below.

The answers provided through this submission form will be used strictly in line with the objectives defined below. The application form is coordinated and processed by the Lycée International de Valbonne (LIV). Such processing is based on your consent to these terms and conditions, which you accept by completing this questionnaire. Should you wish to exercise your right to correction, erasure, restriction or portability of your data or just wish to know what personal data we hold on you, please contact the Data Controller at: Fatima.Moujdi@ac-nice.fr. All the data will be deleted at the end of 2021. If you have any questions regarding this survey, please contact Fatima Moujdi (Fatima.Moujdi@ac-nice.fr).

Your personal data will not be shared outside of the Lycée International de Valbonne (LIV), EUN Partnership AISBL, the Asociación Española para la Enseñanza de las Ciencias de la Tierra (AEPECT) and it will be deleted 3 years after the end of the Schools Tune into Mars project or if you have not given or revoke your agreement to be included in the database. Except where this is indicated in the terms of Google Privacy Policy, your information is not intended to be transferred to destinations outside of the EU/EEA (European Economic Area), although it may be accessible to parties outside the EU/EEA via online media and websites. However, an exception might also be where you are located outside the EU/ EEA and we need to follow-up with you regarding your submission.

If you have any questions regarding this survey, please contact Fatima Moujdi (Fatima.Moujdi@ac-nice.fr). Should you have any complaints regarding data protection, you can contact the French Data Protection Authorities.

This questionnaire is supported by Schools Tune Into Mars, a project financed by the Erasmus + programme and coordinated by the Lycée International de Valbonne (LIV) in collaboration with EUN Partnership AISBL, the Asociación Española para la Enseñanza de las Ciencias de la Tierra (AEPECT) and the National Institute for Earth Physics (NIEP). All anonymous data collected via this survey will be made freely available online (open access). In addition to the above, the form may be subject to the terms and conditions in Google Privacy Policy, which may be consulted at https://policies.google.com/privacy?hl=en.

Section I - Survey

Email address*
Last Name*: First Name:
Gender*
Organisation (institution)*
Location (TOWN)*
Location (COUNTRY)

Your role (multiple choice)*

1. Director (primary school)
2. Head of School (secondary school)
3. School Inspector
4. Science department representative
5. Teacher trainer
6. Policy maker
7. Teacher

If other, please indicate:

2. Organisation (multiple choice)*
1. Primary school
2. Middle school
3. High school
4. Education department
5. University
6. Other

If other, please indicate:

Your organisation is (one answer)

Private
Public
Other

If other, please indicate:

Number of Teachers in your organisation (not mandatory, only if it is the case)

1. 5 - 10
2. 100 – 300
3. 300 – 600
4. 600 – 1500
5. 1500 - 2500

Section II - Survey

In your country, which is the status of Earth & Space Science activities?

1. They are part of the national curriculum with specific classes
2. They are integrated in other disciplines of study such as ....
3. They are not present as such in the national curriculum

Teachers benefit from professional development in the field of Earth & Space Science.

a. Through their initial education as teachers (they are qualified for this domain)
b. Through continuous development activities participating in trainings provided by various providers
c. There are no professional opportunities I know on the subject

Do you think this is a field of interest for teachers, students?

a. Yes
b. No

In your opinion, what is the value of doing STEM approaches to Earth and Space science in the classroom? (Rank your answers according to this scale : 0 - No important; 1 - less Important; 2 - Important; 3 - Very important; 4 - Crucial)

a) Discovering scientific professions
b) Promoting skills needed in science careers for students
c) Developing scientific approach, critical thinking, creativity, curiosity, acceptance of failure and more)
d) Enabling girls to discover new perspectives on career development by introducing new skills.
e) Other
If other please specify:

What would you suggest to contribute significantly to the professional development of teachers in the field of Earth Science & Space (Rank your answers according to this scale : 0 - No important; 1 - less Important; 2 - Important; 3 - Very important; 4 - Crucial)

a) Providing online training courses containing scientific knowledge, STEM activities to be carried out with their students and a discussion and peer-to-peer forum for teachers and laboratory technicians.
b) A website containing conferences with researchers, STEM activities and other educational resources in “Earth science & space”.
c) An European framework for education in “Earth science & space”.
d) Other
If other, please indicate:

In your opinion, why is it important for schools to get involved in Earth Science & Space based learning activities? (Rank your answers according to this scale : 0 - Not important; 1 - less Important; 2 - Important; 3 - Very important; 4 - Crucial)

a) To contribute to professional development by updating teachers’ scientific and technological knowledge in Earth science & space.
b) To contribute to professional development by training teachers in interdisciplinary and innovative teaching practices in their classrooms.
a) It is a relevant scientific field
b) It connects to societal challenges
c) To promote the study of Earth science & space and STEM careers among students.
d) To increase girls’ interest in Earth Science & space.
e) Other
If other, please indicate:

Which should be the main stakeholders involved in these activities?

a. Science community
b. Industry
c. Scientific associations
d. University

Why, from your point of view, is it important for the science community to engage in school activities and partnerships related to Earth science & space ? (Rank your answers according to this scale : 0 - No important; 1 - less Important; 2 - Important; 3 - Very important; 4 - Crucial)

a) Motivating students to pursue STEM careers in Earth science & space.
b) Developing a close collaboration with teachers that will allow them to master new technologies based on data acquisition and interpretation
c) Providing students with positive and realistic demonstrations of the scope and limitations of science and scientists
d) Contributing to the continuing professional development of teachers
e) Communicating their research and development of the field
f) Bringing together professionals and students for further collaborations
g) Other
If other, please indicate:

According to you, what motivates policymakers to promote Earth Science & Space based learning activities? (Rank your answers according to this scale : 0 - No important; 1 - less Important; 2 - Important; 3 - Very important; 4 - Crucial)

a) To address the deficit of researchers and engineers in Earth science & space.
b) To train and motivate more girls in Earth science & space.
c) To contribute to a better understanding of rocky planets such as Earth and Mars from the earliest years
d) To contribute to the initial and continued training of teachers in the field of Earth science and space.
e) to address present, relevant societal challenges

Which factors, do you think, really influence teachers' use of the science community as a resource? (Rank your answers according to this scale : 0 - No important; 1 - less Important; 2 - Important; 3 - Very important; 4 - Crucial)

a) The need to update their scientific knowledge
b) The know-how about innovative resources related to scientific issues
c) The possibility to participate in projects that expand the framework of their educational institution
d) The promotion of scientific spirit and inquiry among their students
e) to increase relevance of their learning activities
If other, please indicate:

What are the main driving forces that motivate and strengthen this collaboration between teachers and researchers according to you? (Rank your answers according to this scale : 0 - No important; 1 - less Important; 2 - Important; 3 - Very important; 4 - Crucial)

a) Setting up projects between teachers and the world of research and industry
b) Making the school part of scientific projects at an European and/or international level
c) Making STEM education visible at the school level and promoting greater interest in STEM subjects among young people
d) Inspiring young students to become researchers
e) Promoting collaborations between researchers and the teaching community (including both teachers and technicians)
If other, please indicate:

In your opinion, how should Earth & Space Science education be promoted ? (one choice)

a) Providing teachers with new and innovative practices for teaching STEM
b) Reinforcing some STEM aspects of the curriculum in Earth science & space.
c) Proposing a STEM strategy and action plan to support institutions in the implementation of STEM education.
d) setup a network
d) Other
If other, please indicate:

What can our project do to add real sustainability, scalability and long-time support to an initiative like Schools Tune Into Mars (STIM) ? (Rank your answers according to this scale : 0 - No important; 1 - less Important; 2 - Important; 3 - Very important; 4 - Crucial)

a) To encourage continuous and/or periodic communication between the scientific community and teachers
b) To promote annual meetings / congresses between the scientific community and teachers
c) To carry out an annual webinar between the scientific community and professors
d) To encourage students to be in contact with scientists to carry out school research projects
e) to offer teacher-training courses on current science topics with educational resources ready for an easy use in the classroom

14. Which are the most effective methods for training teachers and newly qualified teachers on Earth and Space science ? (voluntary and open question)

15. What measures should policy makers take to lower access barriers to training programmes on space science education? (voluntary and open question)

“The objective of the Schools Tune Into Mars (STIM) project is to contribute to the professional development of teachers by increasing knowledge and the use of current research data. To allow teachers to develop the high STEM skills for students which will be needed in their future careers. But also, to increase young Europeans’ knowledge, skills and interest in STEM education.
In this regard, STIM project offers teaching materials related to STEM subjects and developed following a co-constructive process between researchers and teachers within topics such as planetary seismology, geology, geophysics, Earth and space sciences.”
To learn more about the STIM project, click on this link : https://insight.oca.eu/fr/stim-resources LINKS
https://insight.oca.eu/fr/stim-resources
https://twitter.com/STIMerasmus
http://www.scientix.eu/projects/project-detail?articleId=777418
The personal data collect will be used only for:
- contacting to share the results and to develop recommendations targeted to the creation of a new network called mars-Edu network
- These recommendations meant to be presented to inform and provide advice to educational policy makers and promoting Space science education
- working on the sustainability of the project with the first objective to develop innovative pedagogical resources related to Space
Consent Do you agree with the survey’s privacy notice? By responding yes to this question you are given us the permission to process your personal data specifically for the purposes identified above.*

a. yes
b. no

Disclosure Project partner institutions will not pass on your personal data to third parties without first obtaining your consent.

Disclaimer